ILLUMINATING ENGINEERING

SEPTEMBER 1952

National Technical Conference In Abstract

THE JOURNAL OF THE ILLUMINATING ENGINEERING SOCIETY

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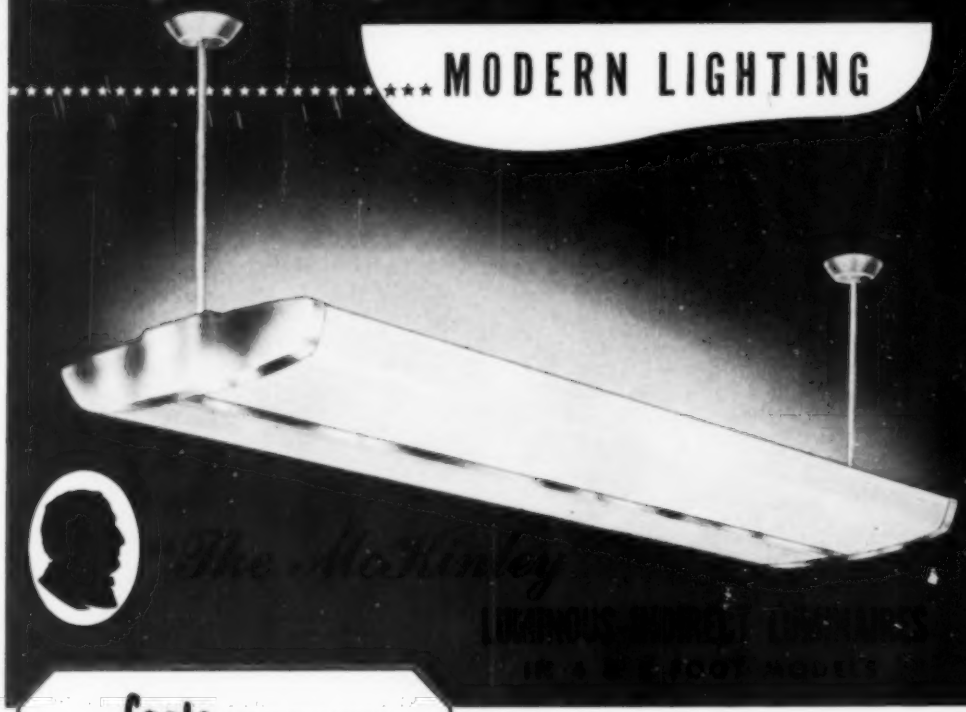

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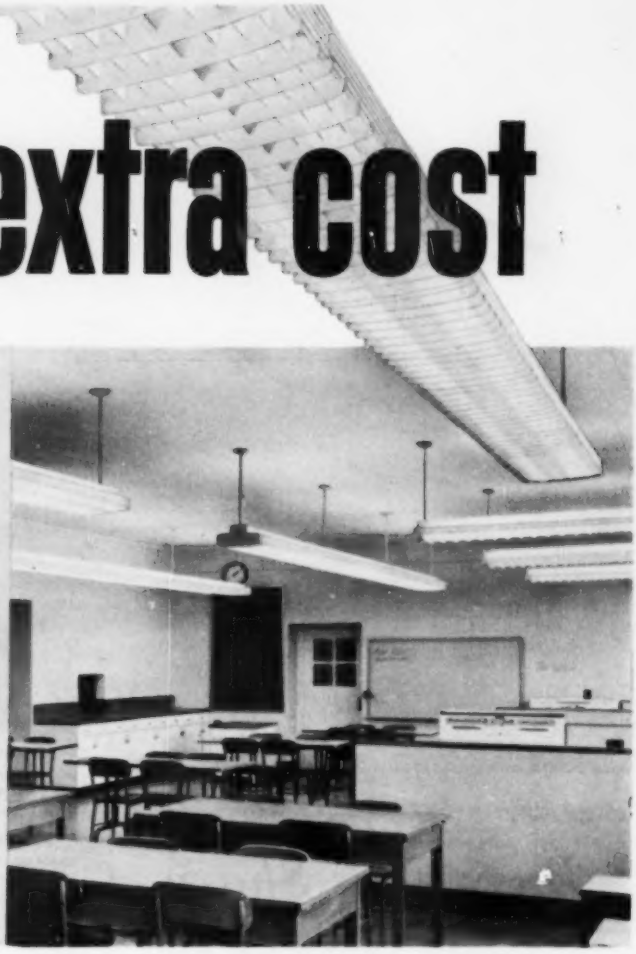

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ILLUMINATING ENGINEERING

THE JOURNAL OF THE ILLUMINATING ENGINEERING SOCIETY

SEPTEMBER
1952

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Founded 1906

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Executive Secretary

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PUBLICATION office 32d Street & Elm Avenue, Baltimore 11, Md.

EDITORIAL and advertising offices 1860 Broadway, New York 23, N. Y.

ILLUMINATING ENGINEERING: The Journal of the Illuminating Engineering Society. Copyright 1952 by the Illuminating Engineering Society. Published monthly in the United States of America. Entered as second-class matter at the Post Office, Baltimore, Md. Acceptance for mailing at special postage rates provided for in Section 1103 P.L.&R., Act of October 3, 1917. Authorized July 16, 1918. ¶ Subscription $10 per year plus extra postage to all countries to which second-class postage rates do not apply; single copies $1.50. ¶ Address changes must be received at I.E.S. headquarters by the first of the month to be effective with the issue of the next succeeding month.

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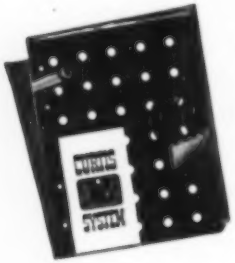

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The President's Address

Our 1952 Administration

By S. G. HIBBEN
President

AS WE APPROACH the completion of the first half century of our history, we find our Society firmly established, strong and determined in its achievements and objectives; cooperative and friendly among companion scientific organizations and in excellent repute for its forthright encouragement and coordination of lighting knowledge and the dissemination thereof.

In these five decades this organization, to a large degree, has achieved a position of worth in society and can look with justifiable pride on its contributions to the betterment of living. Among our greater accomplishments and credited to successive administrations, has been the establishment of the coordinated framework, because the structure and the machinery must first be erected and tuned to a smooth output before the outflow of product can be assured — before the industry and the public are convinced that the product is a *good* product! From hence on indefinitely we may hope that the character of our output and the acceptability — aye, the vital need — of our influence may increase. More work, then, can now be devoted to output — less, in proportion, to methods, rules, laws and organizational details. We are all "set to go"!

In his Presidential address of 1913, President Millar, after making a country-wide survey, said in essence that as provided with capable and farsighted leadership, there seems no reason why the I.E.S. may not successfully go forward indefinitely. I have little fear of the high caliber of our future leaders, but I cannot refrain from pointing to the superior moral and ethical standards in the Lighting Fraternity that were enshrined by our pioneers when they established this Society to be an enduring monument of fact and truth, a beacon sending its rays of knowledge, health and happiness into all the dark places. Thus let our leaders understand the "bigness" of their influences and their responsibilities! To these of tomorrow I may say, with a tinge of regret but the comfort of confidence, "morituri te salutamus"!

First, then, let me admonish you even though I truly know that you have my same aspirations, to avoid petty conflicts of commercialism or jealousy or any serious evasions of truth, and to keep our high character as an unbiased technical brotherhood in which anyone may have firm confidence. This Society carries a torch for posterity that we must not permit to grow dim! We dare not lay it down!

It seems unnecessary to discuss the details of our operating machinery. Our Headquarters' staffs are functioning well and are to be congratulated upon their familiarity with all duties and their initiative in carrying forward our regular business. Financially we are operating carefully within our income and we are building up in addition to pensions and retirement funds, a modest reserve invested in gilt-edged securities as against any sudden depressions or unforeseen contingencies.

As in the past, one important objective of our current era is to grow in numerical membership and to grow in the classifications of membership where we are not yet well represented. As to the first, our recent net annual growth of 3.5 per cent is stable and encouraging and commendable, but not exuberant! During this administration we have added six new Chapters (Tulsa, Phoenix, Pueblo, Albuquerque, Albany and Peoria); have transferred five Chapters to Section status and have established one new region (Inter-Mountain), making ten in all. There is some deep concern being felt over the fact that among our 57 Sections and Chapters, the local membership has lost ground in some fourteen. It is recommended that whereas in such cases the Society's activities may be slowed down, an especial effort be made to recharge local enthusiasm with some thoughtfully selected outstanding meeting programs and speakers. As a

Substance of an Address presented by the President of the Illuminating Engineering Society, before the National Technical Conference of I.E.S., Chicago, Illinois, September 8-12, 1952.

help toward this end, the "speakers list" has been revised and reissued.

As to the expansion in new classes of members, may I call attention to the great mutual value that might occur if some means be found to make I.E.S. membership attractive and profitable to that host of people whose interest in lighting might be termed "marginal." I recommend a continuing study of an additional membership classification, applying to electrical wholesalers and retailers, sales personnel, contractors and interior decorators and those who are actually in close touch with the consuming public. Then, too, we have possible expansion of interests in the fields where both membership and the dissemination of knowledge would be fruitful, and I have in mind such groups as those interested in certain influences of radiation in animal husbandry, plant growth and flora disease control, bacteriology, photochemistry and some phases of astronomy. In most of these applications, lighting equipment and fundamentals are involved, so the borders of the I.E.S. are not being trespassed.

Such expansions of interest bring to mind the fact that in this administration we have achieved a more democratic method of nominations and elections of National Officers (the revision of By-laws Section I, Article VI). As previously recommended, we have also tried to encourage a rotational scheme such that Officers and members of the Boards of Managers of Sections and Chapters be partially carried over into a succeeding year.

More of the Society's important business will and should devolve upon the shoulders of the Regional Vice-Presidents in the Regions; upon the Senior Vice-President to expedite the work of Technical Committees and upon the Junior Vice-President to develop still further the Local Activities. Now that a complete activities guide is available, we look forward to fuller meetings, better programs and in all, better local services to the membership. Since it has been my privilege to attend all of the eight Regional Conferences, I can attest to their value and I bespeak the membership's approval of their continuation. Some might well be extended to three days where a wealth of local knowledge may be exchanged.

Research is still our business! The procurement of lighting knowledge remains a fundamental necessity. We do not know all of the answers! We still have much to study, much to digest and appraise, much to search out, beginning with the physiological functions of seeing and carrying through to the research work on better instruments, more perfect sources of radiation, better coordination, the logic of specific applications, and undoubtedly better methods of teaching. Happily, in our International relations (and we should strongly support the C.I.E. in these matters), the Lighting Fraternity is in close accord as concerns nomenclature, fundamental practices and the mutual understandings of lighting problems.

Nevertheless our Society needs an expanded research program. Some investigations were recently made seeking best methods of raising funds for lighting research and, in general, it seems apparent that a separate method of collecting such funds is not now feasible if it be predicated on enlarged support from present donors. For several reasons, I recommend that the solicitation of research funds be united into that of sustaining memberships (one Committee) and that a substantial enlargement of "sustaining membership" income be planned with the understanding that all such money collected into the I.E.S. Treasury be handled with the definite expectation that a substantial percentage is to be set aside, preferably on a basis of three or even five years guarantee of major research grants. In this way there would be no duplication of solicitation, or support, no duplication of influence nor divided control and little uncertainty as to continuing availability of funds for certain extended projects.

The backbone of strength of our Society's output is made up of integrated technical committees. We have added a few new ones (on "Elements of Signal Lighting"; on "Cooperative Promotion of Light as a Safety Factor"); also four additional subcommittees, and almost all of these have worked faithfully and well. More than one thousand members (one out of seven) give of their time and counsel to our seventy-one committees! It is impossible to place too much emphasis upon the value of output of these Committees because where else in the nation and from what other sources could we obtain our guides for lighting practice, or for our fundamental facts to be incorporated into national standards, or even into our laws and guidances? In order to coordinate the technical committee work, I urge the continuance of at least one annual gathering of all Chairmen, and all reasonable emphasis put upon the planned docket for that gathering. Furthermore, I see value in the experiment to have certain field studies aided by personnel loaned from headquarters.

Our publications, particularly ILLUMINATING ENGINEERING, have reached maturity and must unquestionably be continued and still more firmly established as the recognized source of lighting knowledge. The membership generally agrees that it has been well to brighten and enliven some of the material in this publication. ILLUMINATING ENGINEERING is a readable magazine as it stands and it is the visible and only contact enjoyed by the

(Continued on page 497)

Charting I.E.S. Through 1953

By **EVERETT M. STRONG**
President-Elect

FROM TIME TO TIME the I.E.S. elects to the presidency an engineer in the field of education — a professor. The most recent of these, Professor Henry B. Dates, was the thirty-third president. That was fifteen years ago, a longer interval between professors than any in the near half-century life of the Society.

It does not follow that the educational activity of the I.E.S. has lain dormant during this latter third of the Society's existence, but it does invite searching review and assessment of both progress and objective in its educational program.

Education, both formal and informal, is a vital element in the very Constitution of the Society: "Its object shall be the advancement of the theory and practice of illuminating engineering and the dissemination of knowledge relating thereto." In short, its object shall be research and education. These items properly are associated with the college campus but they are by no means confined to the campus; they exist wherever active curiosity and communication abound. I shall not recite here the educational record of the Society which is thoroughly documented in our many publications, in our local, regional and national technical conference meetings, and in the productivity of our technical committees, including the I.E.S. Handbook. Neither shall I enumerate here the research contributions of the I.E.S. Fund, noteworthy as they are. Nowhere in the realm of organized technology is there a group of men and women more actively, more constructively and more unselfishly devoted to the progress of their work than the members of I.E.S.

But in the realm of education, illuminating engineering presents some unsolved problems, and they are of far-reaching significance to all who are active in the practice of lighting. The art, if not the science, of lighting is very old, dating back through eras of candles and oil lamps to that of the pine knot. In view of the fact that light and lighting have their origin before Benjamin Franklin flew a kite, it is a curious fact that electricity has far outdistanced lighting in the engineering stature it enjoys, not only on our campuses but in our structure for licensing and generally throughout the realm of professional engineering. Like it or not, illuminating engineering professionally leads very largely a parasitic existence, feeding on the substance of electrical engineering for professional nourishment and legal status. This has always been so, but for what reasons? Is the relation inherent, and must it long endure?

There is no fundamental reason why illuminating engineering should continue indefinitely under the electrical wing. But there are nevertheless one or more circumstantial reasons why the status does exist and why it persists. Of course, the influence of electric power as the principal source of "man made" light is obvious. Yet whether you cook with gas or electricity does not identify the preparation of food particularly with one or the other source of heat; the process fundamentally is chemical and is so identified. If lighting is of no less stature than food processing, there must be other reasons more cogent than source of energy.

The burden I am sure is not to be borne by one all-potent reason alone and this is not an occasion to indulge in exhaustive analysis. But there is one facet to which I would invite your attention here. If you are injured by electric shock or burn, you can go to court and obtain judgment whether you were the victim of faulty engineering. You can obtain judgment whether faulty engineering was involved in the falling of a bridge or building, in the bursting of a boiler, and in the failure of a machine, but *you cannot obtain judgment whether faulty illuminating engineering drove you blind* or impaired your eyesight! Why do you go to a civil,

Substance of an Address presented by the President-Elect of the Illuminating Engineering Society, before the National Technical Conference of I.E.S., Chicago, Illinois, September 8-12, 1952.

chemical, mechanical or electrical engineer? Simply because you dare not assume the legal and moral responsibility yourself for the hazards which can be legally assessed. But illuminating engineering for the most part is not yet so identified with assessable hazards.

Illuminating engineering therefore does not flourish on a fear-motivated demand but must attain growth and stature largely by the creation of a more enlightened motivation. This requires more than the mechanics of fixture hanging and more than the directing of light flux. Lighting is for *people, primarily* and *intimately*. Its effects on sight-gifted people, therefore, are of major importance. No similarly intimate human consideration is identified with boilers and generators and pumps. But the study of vision is a complex and difficult task still insecure of reward in science and little understood by engineers.

For this reason alone there are some who would question whether lighting so distinguished from the installation of lighting equipment is properly identified with engineering. Perhaps unwittingly, they do not thereby contribute to the stature illuminating engineering deserves. Engineering, like education, encompasses a wide spectrum of scopes and competencies and I submit that illuminating engineering when identified with its proper scope of ultimate concern with *people* is engineering of the highest order, challenging, stimulating, far beyond the mere concept of technology which is but one element of the greater art and science of engineering. The future hope of stature for illuminating engineering lies in the vigorous pursuit of a scientific knowledge of vision by men of outstanding courage and competence, a pursuit which we in engineering do well to foster actively and substantially for our own inheritance.

This concept of illuminating engineering, I am confident, is the motivating spirit of the I.E.S. by which it is a unique instrument of more than average human flavor among organized technologies. The members of I.E.S., especially the technical committee members who contribute to our fund of lighting knowledge, and the many other workers who disseminate this knowledge through their activities in the local, regional and national meetings as well as through the individual efforts of Local Representatives and others, make this coordinated and concerted effort the growing, effective, spirited, human body that it surely is.

I am ever mindful that we cannot rest on our oars to coast on the reputation of previous achievement. The good ship I.E.S. is not a lightship to be moored for signalling danger; it must steam on into uncharted waters. Much as we know about lighting, neither our fund of the technology of light flux nor our knowledge of sight-gifted people is more than under way. We do grope in the darkness of abysmal ignorance compared with what another decade or two will disclose, and it is a prime responsibility of the Society to give high leadership to the encouragement of adequate talent and funds for finding, organizing and applying the new knowledge we now lack on so many aspects of our overall engineering problem. We must bring to our technical committees new implementation, new instruments, new standards and new concepts before we can achieve this kind of progress. Lighting research must expand manyfold and lighting education in all its ramifications must grow in volume and stature far beyond our present concepts. This cannot come in the main directly from the Society but essentially through the *leadership* of the Society in a well-balanced union of imaginative and factual talents exercised in the organized active teamwork that I.E.S. stands for throughout the civilized world.

By no means can this activity center about the Society Headquarters. As the Society and its work grows, the Regional units become more and more important, and nothing is more vital than the healthy activity of the Sections and Chapters. I believe that the Regional Vice-Presidents understand the considerable responsibilities and opportunities now incumbent on their offices; I know that they will find somehow the time and energy to carry out their work in the spirit and the detail required.

All connected with our Sections and Chapters well understand that good programming, good publicity, active members and sound finances go together to spell success. Our Local Activities and our Public Relations Committees are doing a superb job. Guides to ease the perplexities of almost any local or regional activity have been prepared and they are well worth digesting.

Through the years and especially of late, you have chosen presidents with hobbies strongly nautical. I am happy and honored to be counted among these skippers — they belong to a fraternity of high respect for the forces of Nature and of man, with devotion to both in the charting of life's seas.

The course of the Society demands the highest order of attention to navigation, not only from buoy to buoy and port to port, but as far ahead as we can project our objectives into the future. I am hopeful that we can find the time and energy and be granted the wisdom this year to bring more clearly into focus on our chart, the hazards we must navigate and the course that will not only keep us afloat but "making knots" toward a brighter future for man's visual environment and welfare. With your helping advice and your earnest, active, support, we shall cruise through 1953 with a well-trimmed ship and a log of sound accomplishment.

Abstracts . . .

from the General Technical Sessions of the I.E.S. 1952 National Technical Conference

The Zonal Method of Computing Coefficients of Utilization And Illumination on Room Surfaces

THE Zonal Method is a method of computing coefficients of utilization for use in determining the illumination on the work plane, walls, and ceiling.

Data were presented (page 601 of the December 1951 issue of ILLUMINATING ENGINEERING) for calculating work plane coefficients of utilization for certain luminaire spacing and mounting arrangements for areas having a floor reflectance of 14 per cent. In this paper, an additional floor reflectance and other spacing and mounting arrangements are considered.

The coefficient of utilization for the work plane is determined by first calculating the percentage of luminaire lumens that strikes the work plane directly. This is called the Direct Ratio. To obtain the total light striking the work plane, it is necessary to add to the Direct Ratio the light that is reflected from the room surfaces to the work plane. The reflected components are presented in convenient curve form for all room indices "A" through "J."

The accuracy of the Direct Ratios can be checked by comparing them with coefficients of utilization obtained from point-by-point calculations. Such comparisons prove that the Direct Ratios are accurate. The reflected components are taken from the Interflection Tables. The accuracy of some of these tables has been proven experimentally. The other tables have been used in practice with equal success. All were calculated by the same technique as those verified experimentally, and their accuracy appears well established. Also, Zonal Method coefficients have checked closely with measured results in installations where comparisons have been made.

The Zonal Method also provides easily used tables and curves for quickly determining the average illumination on the walls and ceiling for floor reflectances of both 14 per cent and 30 per cent.

AUTHORS: Westinghouse Electric Corp., Bloomfield, N. J., and Cleveland, Ohio, respectively.

J. R. Jones

John J. Neidhart

The authors believe the Zonal Method is a more satisfactory system for making lighting calculations than the present Society method because:

1. The disposition of the luminaire lumens in *each* 10° zone is considered in determining the flux that strikes the work plane directly. The use of the relatively small 10° zones provides greater accuracy. The present Society method considers only the lumens in the 0° to 40° zone to classify downward distributions into one of six classifications, and luminaires falling into the same classification are expected to have equal utilization factors.
2. The coefficient of utilization may be calculated for areas having a floor reflectance of either 14 per cent or 30 per cent. The present system considers only areas having a 14 per cent floor reflectance.
3. Average illumination (or brightness) of walls and ceiling may be easily determined. The present method does not treat the subject of room surface illumination.

(Abstract of I.E.S. 1952 Conference Paper No. 22)

George P. Wakefield

Control and Measure of Directional Flux at the Task

THE direction in which light is reflected from the task in relation to the eye is an important factor in a study of reflected glare. This directional component aimed at the eye lowers the contrast between the printed type and the paper and is detrimental to good visibility. To see this effect at its extremes, a photographic method was devised (see Fig. 1) to illustrate maximum and minimum reflected glare by directional control of the light source. In this manner a direct comparison is made on each picture. With extremes illustrated, we can conclude that all variations lie in between, provided the task is the same. By variation of the task, the diminishing effect of visibility is always apparent by comparing the left side of the photo with the right.

AUTHOR: F. W. Wakefield Brass Co., Vermilion, Ohio.

We see, then, that the degree of reflected glare attainable is directly dependent upon the control of the direction of flux. Following this line of reasoning further, why not devise a measuring means using the standard footcandle meter as the recording cell. To do this the cell was mounted at a 45° angle just above a plane mirror. The whole assembly was turnable on a central axis with increments of $22\frac{1}{2}°$ on a stationary base. The direct readings of the cell were plotted on a polar curve to depict the reflected component and its relation to the eye. From these curves a formula was proposed as an evaluation factor.

Conclusions drawn were:

1. The photographic method of showing maximum and minimum reflected glare on one print is an effective means of illustration and demonstrates the value of direction of flux as a reflected glare control.

2. Most workday papers show characteristics causing reflected glare.

3. An instrument for measuring the reflected directional component seems practical. A rating system also seems possible.

4. Direction of flux appears to be an important tool for the illuminating engineer to utilize effectively in attaining degrees of comfort and visibility at the task, heretofore unrealized.

(Abstract of I.E.S. 1952 Conference Paper No. 23)

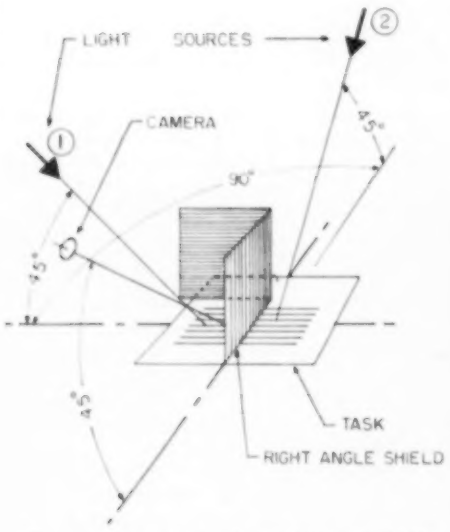


Figure 1. Schematic drawing of right angle shield technique.

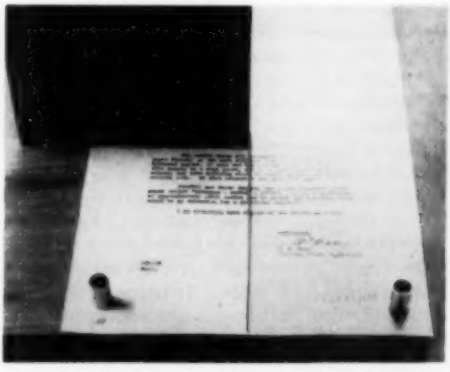


Figure 2. Office bond under medium brightness sources.

Visibility of School Tasks

J. M. Ketch

C. J. Allen

IN ORDER to understand better the visual work performed by school students, this paper catalogues and analyzes representative samples of visual tasks encountered in the grade schools.

Many examples of the work the students do were found to be surprisingly low in visibility. The spelling list, the mechanical drawing problem and the sewing exercises shown in the accompanying illustrations are examples where the measured visibilities were so low as to be equivalent to the visibility of three-point Bodoni Monotype printing. An example of such size type is shown under the illustration.

Light pressure writing with a hard lead pencil was found to be the most common offender of good visibility. As an experiment, duplicate spelling lessons were written by a student, who writes with a good pressure, using a No. 1, soft, a No. 2, medium soft, and a No. 3, medium hard pencil on white paper. The equivalent point-size visibility dropped from 15 to 11 to 7 as a result of the grade of pencil used. When the child wrote the same spelling lesson on yellow paper with the same three pencils the comparable point sizes lowered to 13, 8 and 3 because of the lower reflectance of the paper and the resulting lowered contrast.

AUTHORS: General Electric Co., Application Engineering Department, Cleveland, Ohio.

Among the visual tasks studied some of the most difficult seeing conditions found were: poor quality mimeographing and liquid duplicator reproductions, name places on maps, small figure mathematical tables, mechanical drawing scales, and preliminary pencil drawings such as those made in biology classes. Many examples were noted where the equivalent visibility of such groups of tasks varied between three- and six-point Bodoni Monotype.

The reading of text and reference books occupies a large portion of the students' learning years. The actual two hundred and twenty individual books used in the East Cleveland, Ohio, school system from the first to twelfth grade were collected. The typography of each was measured as to the total height of the type faces, the height of the round part of the lower case letters, the interlinear space between the type faces, and the reflectances of the inks and papers used. The accompanying chart shows the results of one of these tests; it indicates the gradual decrease in total height of the type as

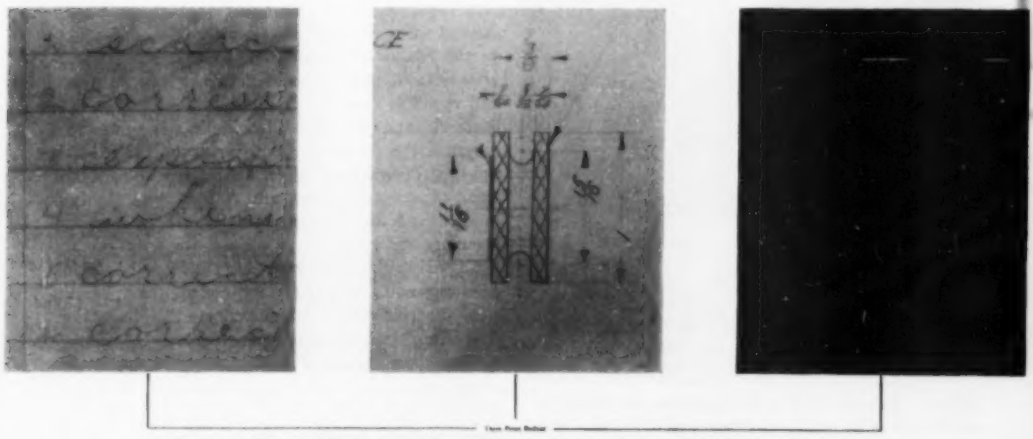


Figure 1. The visibility of the above school work is equivalent to the type size shown.

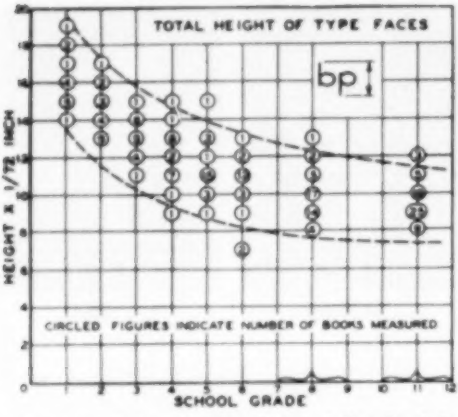


Figure 2. Variations in size of the printing found in actual text books used in the E. Cleveland, Ohio public schools.

the students progress from the period when they are learning to read, to the period when they are reading to learn. This chart together with the other charts presented in the paper can be used in evaluating text book printing where better-than-average typography is wanted.

The three general conclusions reached were: 1) Many visual tasks are inherently difficult and any improvement in visibility must be obtained through improving illumination and environmental conditions, 2) The charts which show the variations in print sizes and ink contrasts could be used as a guide in selecting better-than-average printed material for any specific grade, 3) Substantial improvements in seeing conditions can be effected by better supervision of office-duplicated material and by teaching students to write larger with heavier pressure with softer, blacker pencils on good reflectance papers.

(Abstract of I.E.S. 1952 Conference Paper No. 24)

Brightness Discrimination Data for the Specification of Quantity of Illumination

H. Richard Blackwell

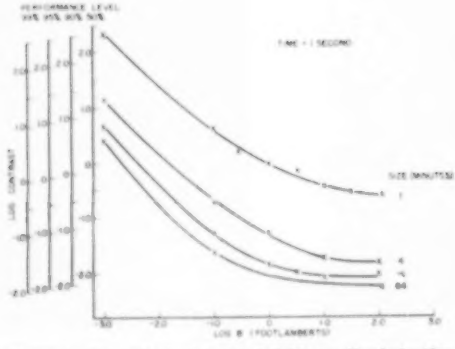


Figure 1. Data obtained in the brightness discrimination experiments with a time of exposure of 1 second. Each point represents at least 500 responses by two subjects.

ONE OF the bases for the specification of quantity of illumination is visual performance. It is reasonable to define visual performance in terms of two indices, accuracy and speed. Because of the complex relations between each of these indices of visual performance and the quantity of illumination, it is desirable to keep them separate rather than to lump them as Weston has done.

Visual performance must be specified separately for each visual task which may be required of the user of light. It is known that the required quantity of illumination will depend upon the visual task involved. It is proposed that the ultimate method for specifying the quantity of illumination, on the basis of performance, be based upon complete sets of experimental data relating accuracy and speed to quantity of illumination, for various basic visual tasks. The illuminating engineer will diagnose the essential visual task required in each lighting installation, select the appropriate set of basic experimental data, and compute the required quantity of illumination for the desired levels of accuracy and speed.

Experimental data have been collected relating accuracy and speed of one basic visual task, brightness discrimination, to quantity of illumination. The visual task required the experimental subjects to detect the moment at which a circular brightness

This research was sponsored in part as Project #30 of the I.E.S. Research Fund and in part by Contract NObs 54343 between the Bureau of Ships, U. S. Navy and the University of Michigan.
AUTHOR: University of Michigan, Ann Arbor, Mich.

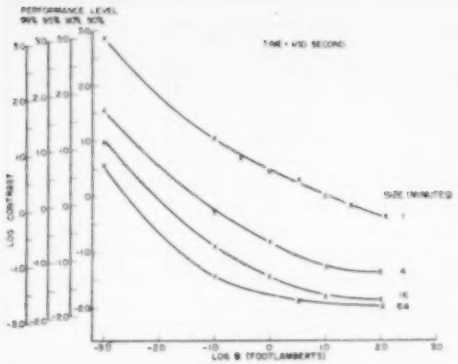


Figure 2. Data obtained in the brightness discrimination experiments with a time of exposure of 1/10 second. Each point represents at least 500 responses by two subjects.

increment was added to a large, uniformly bright background. The diameter of the circular brightness increment was varied in separate experiments from 1 to 64 minutes of arc. In each experiment, five brightness increments were presented fifty times each, and the accuracy of detection was recorded. In separate experiments, the exposure time of the brightness increment was varied from 1/1000 second to 1 second.

Average data for two subjects are presented in Figs. 1 and 2, for exposure times of 1 second and 1/10 second. Contrast is defined as $\Delta B/B$, where ΔB is the brightness increment and B the brightness of the background. Each figure contains experimental data for increments of four sizes. Accuracy of performance is represented by a series of ordinates.

We may illustrate the use of these graphs in specifying the quantity of illumination as follows: Consider a brightness increment with contrast = 1. Log contrast = 0. Suppose the brightness increment of interest has an angular diameter of 1 minute. We may determine the brightness of background, B, which will result in various levels of accuracy for each exposure time, directly from the figures. The following values of B in footlamberts are obtained:

	Accuracy			
Duration	50%	90%	95%	99%
1 second	1.0	2.5	3.6	4.8
1/10 second	10.	20.	33.	59.

We may of course convert these values of B into illumination levels from the reflectance of the background of interest.

Such a table of values as this permits us to specify the quantity of illumination for any level of accuracy from 50 to 99 per cent, and for any speed of brightness discrimination from 1 per second to 10 per second.

(Abstract of I.E.S. 1952 Conference Paper No. 4)

Cost and Comfort Appraisal of Industrial Lighting Systems

George J. Taylor

R. D. Bradley

INDUSTRIAL seeing tasks have become more critical with speeded production, closer tolerances, the need for greater accuracy. Lighting recommendations for industrial areas must now include specifications for lighter surfaces, and luminaire design characteristics which provide a high quality of *illumination*.

That quality in an industrial lighting system is as essential as for offices, is now a concept conceded by all. Actually, the steps to quality are simple.

AUTHORS: Day-Brite Lighting, Inc., New York, N. Y., and St. Louis, Mo., respectively.

1. Provide an adequate level of illumination for a given visual task. 2. Lighten all surfaces — ceiling, walls, floor, bench tops and machinery in colors as light as practicable for the area involved. 3. More —much more, consideration must be given to improved shielding of light sources and a greater upward component of light. The proper applica-

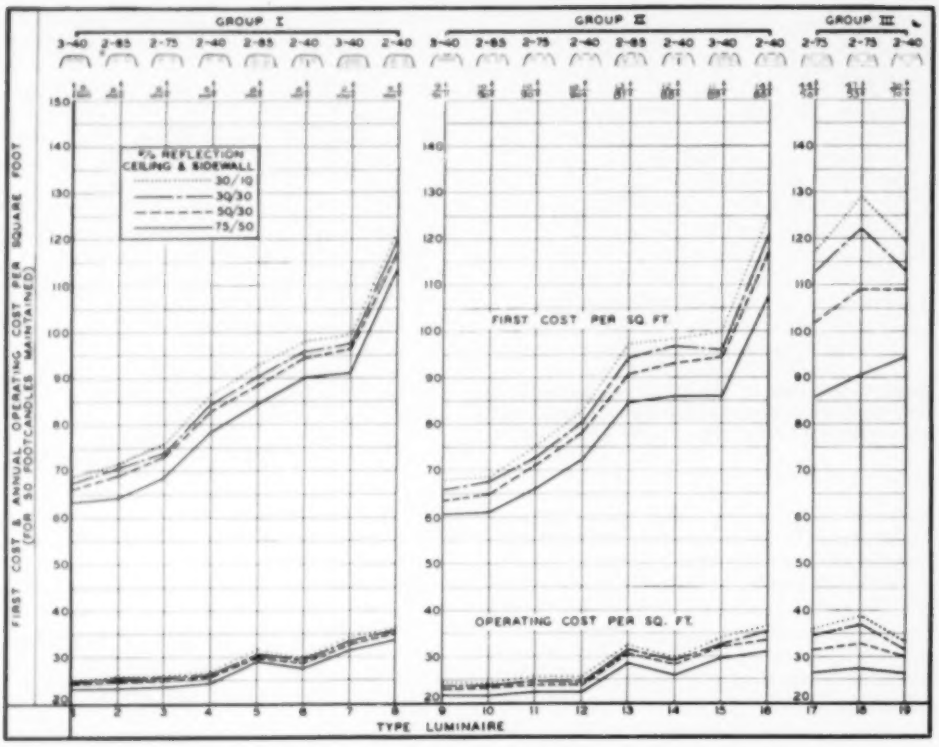


Figure 1. Average costs per square foot for typical industrial type luminaires to produce 50 footcandles (maintained). Lighting cost includes local panel boards and wiring to luminaires.

tion of these three steps leads to *comfort of seeing* — our ultimate goal in lighting for production.

To further aid in the application of quality factors to industrial lighting installations, an analysis was made of 19 industrial luminaires, appraising their characteristics in relation to comfort of seeing, economics and maintenance. The comparative analysis of fluorescent luminaires is divided into three categories:

(1) GROUP I — Solid top reflectors with all light directed downward.

(2) GROUP II — Slotted top reflectors with 10 to 15 per cent uplight and the remaining directed downward.

(3) GROUP III — Open top reflectors with 30 to 50 per cent uplight and the remaining directed downward.

In order to analyze each luminaire type in relation to comfort and economics, a typical factory area representing average construction features with a 14-foot concrete slab ceiling was assumed. Luminaires are mounted 10 feet above the floor. Four factory finishes with reflection factors as follows were considered:

Finish	Ceiling	Walls
1.	75%	50%
2.	50%	30%
3.	30%	30%
4.	30%	10%

Illumination computations were made for the 19 types of lighting systems to provide 50 footcandles maintained. Suggested application of the three groups of luminaires for higher and lower levels of illumination is discussed in the paper in regard to specific seeing tasks.

In this analysis, all pertinent data are tabulated for quick comparison between the lighting systems shown. Also, included in the tabulations are the *cost per square foot* of all the lighting systems, which "specifiers" of lighting find useful in their building estimates. These values together with *operating costs* per square foot are plotted for the four conditions of room finishes of the lighting systems studied.

(Abstract of I.E.S. 1952 Conference Paper No. 23)

Are We Confusing "Eyes" With "Vision"?

Darell Boyd Harmon

THE BRIGHTNESS problem has always been regarded as a problem of glare, discomfort, or some other factor that interferes with recognition of task details. In reality, brightness pattern interference with recognition of detail is only a secondary part of the brightness story, and, if the true brightness problem were solved, the factors related to recognition of detail would be solved as well.

Difficulty in defining lighting standards lies in failure to recognize that there are two distinct but interrelated physiological mechanisms involved in vision, both of which must be taken into account in lighting design.

Bodily systems are action systems and sensation implies performance — overt or covert. Not only must the light density pattern define the task or symbol towards which the action is to take place, but it also must trigger the appropriate bodily organization needed to produce and sustain that action.

Recent advances in the physiology of vision show that meaningful seeing is the product of experience gained through efficient and economic body-balancing and direction of movement. These advances also show that visual recognition and oral or comparable identification alone are not necessarily indicative of productive or meaningful seeing.

Neurological and motor equipment is such that if the brightness pattern is adequate to allow a person to center freely with the task to be performed the process of coming to that centering automatically produces a first-order focusing of the eyes. Footcandles then come into play to induce final vernier adjustments of accommodation needed for recognition of those parts of the task detail which are smaller than standard for the general lighting level.

To perform any task, whether it is to be done by a machine or a human being, requires some base from which to operate. This base must be: (1) adequately anchored with gravity; and, (2) organized to provide proper support for all the moving operations needed to perform a task. Supporting mechanisms and moving mechanisms must be aligned or centered so moving operations can produce the most acceptable product with a minimum of waste, energy, and wear.

AUTHOR: Consulting Educationist, Austin, Texas.

Establishing an adequate base with gravity; aligning supporting structures and moving parts (such as eyes and hands); and, organizing this base, alignment, and direction of movement in a semi-flexible machine such as the human body, is a function of the light gradient over the total visual field, not just the gradient over the central area.

Much of the nervous circuiting leading from the periphery of the retina does not go to the visual recognition centers of the brain at all. These leads go directly to the body posturing mechanisms. The remainder of the leads go to recognition areas in summation only; their signals are mixed in an undifferentiated manner with nervous impulses coming from posturing muscles and from sense organs related to other energy forms; and these integrated signals return again to posturing and motor centers. Consequently, brightness patterns cannot be determined solely in terms of brightness or contrast interference with recognition. Brightness values for performance efficiency must be determined by experiments set up in terms of the way the periphery of the retina is organized with measurements made in terms of motor outcomes and not visibility outcomes.

The product of adverse stresses produced by improper lighting is not reflected merely by measures of acuity, "visual fatigue," blink rate change, or similar tests and evaluations. The damages show over a longer time in adverse adaptations of body structure or growth, or through detrimental metabolic shifts, or through ineffective performance, learning, or attitude. Where the real clue to adverse lighting effects can be found is in the *atypical* visual (non-eye) signs and symptoms of continued body stress in performing visually-centered tasks.

The lighting engineers' pre-occupation with visibility and the recognition of detail does not explain the "how" of productive seeing and visually-centered performance in relation to light distribution patterns. This "how" cannot be found by describing the eyeball as if it were all of vision, separate

and apart from the human being, and as if vision operated independently of all the other operations of the body.

Until lighting engineers apply dynamics instead of statics in studying vision, and begin thinking of vision in terms of total, living, acting, learning, adapting, finely-built and well designed human mechanisms, and not in terms of the "dead-house pathology" of the eye anatomist, they will learn little about standards for lighting. A dis-service to seeing human beings has been the perpetuation of variations of the old "camera" theory of vision by the lighting industry.

Lighting engineers must be concerned with visually-centered performance, visual learning, and visually related body-mechanics — and all the rest of the fields that contribute to understanding meaningful and productive vision and its relation to lighting.

For better lighting our lighting engineers must no longer confuse "eyes" with "vision."

NOTE: The technical points concerning visual dynamics, developed and illustrated at the Conference by slides and demonstrations, cannot, because of needed audience participation, be set forth in this text.

(Abstract of I.E.S. 1952 Conference Paper No. 1)

Left to right

Sylvester K. Guth

A. A. Eastman

R. C. Rodgers

Brightness Difference — A Basic Factor in Suprathreshold Seeing

IT IS accepted that increasing the brightness of a visual task (up to a limiting value generally well above present day lighting practice) increases its visibility. Changes in background brightness are accompanied by changes in object brightness. It is the brightness difference between the object and its background which becomes a significant index in evaluating the effectiveness of illumination.

Table I summarizes threshold data with four letter E test objects of various contrasts. Of particular interest are the results obtained with objects 2 and 4. They have identical contrasts but reflectance differences of 13.5 and 0.68 per cent, respectively. The threshold illuminations for this pair of letters were 0.95 and 18.4 footcandles, which gave equal brightness differences of 0.13 footlamberts.

Visibility measurements with the Luckiesh-Moss Visibility Meter, with levels of illumination up to 100 footcandles, showed that objects 2 and 4 were equal in visibility when their brightness differences with their backgrounds were equal.

It is often overlooked that any specific contrast can be obtained with an infinite variety of combinations of background and object reflectances. The data presented in Fig. 1 illustrate how a given visibility level can be maintained with tasks having four different contrasts, each contrast being obtained with several combinations of reflectances. It is shown that to maintain a given visibility level for a particular contrast, however obtained, the illumination must be such that the brightness differences will be constant.

TABLE I.—Physical and Observed Threshold Data Pertaining to the Four Letter E Test Objects. Reflectances and contrasts are expressed in per cent, and brightnesses in footlamberts.

	Test Object			
Physical Data	**1**	**2**	**3**	**4**
Background reflectance, R_b	95.7	89.9	6.49	4.53
Object reflectance, R_o	2.6	76.3	3.38	3.84
Reflectance difference, ΔR	93.1	13.5	3.11	0.68
Contrast, C	97.0	15.0	48.0	15.0
Threshold Data				
Footcandles	0.044	0.95	2.36	18.4
Relative footcandles	1	22	54	420
Background brightness, B_b	0.038	0.85	0.15	0.83
Object brightness, B_o	0.001	0.72	0.077	0.70
Brightness difference, ΔB	0.037	0.13	0.073	0.13
Relative brightness difference	1	3.5	2	3.5

AUTHORS: General Electric Co., Nela Park, Cleveland, Ohio.

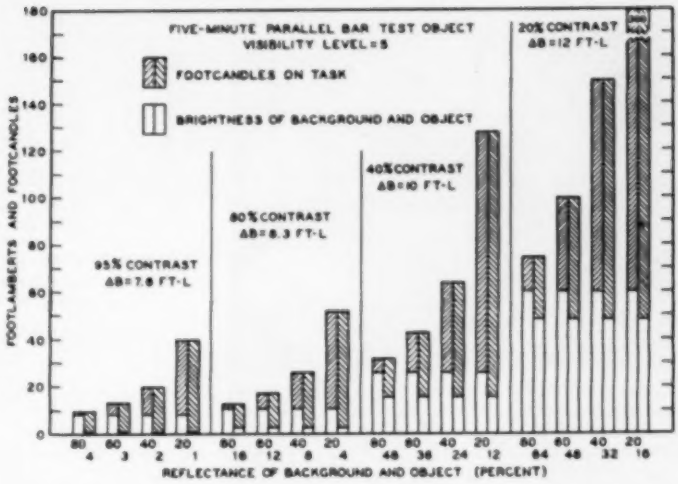


Figure 1. Footcandle, brightness, and brightness difference relationships for a five-minute parallel bar test object at a visibility level of 5 with contrasts of 20, 40, 80 and 95 per cent. Each contrast is obtained with four different combinations of background and object reflectances. To maintain the same visibility level, the brightness difference must be constant for each contrast, regardless of how the latter is obtained.

The brightness difference concept may also be applied to the appraisal of comfort and ability to see. When brightness relationships between the task and surround are converted into differences rather than ratios, both contrast sensitivity and ease of seeing are indicated as decreasing approximately the same for equal changes in brightness difference. This appears to be true regardless of whether the task is brighter or less bright than the surround.

The same general concept can be applied to the appraisal of the comfort of lighting equipment, especially to the larger luminous areas such as are usually encountered in typical installations. A calculation of the relationship between source brightnesses at the borderline between comfort and discomfort and adaptation brightnesses ranging from 5 to 100 footlamberts, indicates that a brightness difference of approximately 45 footlamberts between a task and source brightness should be expected to be comfortable for 90 per cent of the occupants of the area.

The brightness difference concept affords an interesting approach to a better understanding of the benefits that can be received from higher levels of illumination. Greater emphasis is placed upon brightness and brightness relationships. Appraisals can be made in terms of visibility and related directly to threshold observations. The application of brightness difference to ease of seeing and quality of lighting permits a coordinated analysis in terms of a basic and sensitive visual function.

(Abstract of I.E.S. 1952 Conference Paper No. 2)

Silhouette Lighting of Small Diameter Wires

Willard Allphin

AUTHOR: Sylvania Electric Products, Inc., Salem, Mass.

THIS REPORT deals with a laboratory investigation of the principle of seeing a fine wire silhouette, and with a preliminary field application on the catwhiskers for silicon diode detectors.

Most of the experimental work was done on a filament wire 0.0033-inch in diameter. It was supported in front of an easel or an incandescent lamp and reflector covered with flashed opal glass, depending upon whether front lighting or back lighting was being studied.

"Contrast Sensitivity" was measured with a

Figure 1. Apparatus arranged for measuring contrast sensitivities at different brightnesses of a self-luminous background. Brightness meter, contrast sensitivity meter, experimental task and opal glass background. (Camera pointed in predominantly downward direction.)

Cottrell meter. The contrast sensitivity,

$$CS = \frac{p + t}{t}$$

Where p is the per cent transmission of the "periscope" or superimposed beam and t is the per cent transmission of the direct beam through the neutral-gradient filter.

Fig. 1 (Fig. 3 of the paper) shows the apparatus set up to measure contrast sensitivity with a self-luminous background.

Curve A in Fig. 2 (Fig. 5 of the paper) is for the self-luminous background, each point representing the average of ten observations.

Curve B is for the task seen against a white matte paper having a reflectance of 76 per cent. Illumination was from a spotlight illuminating both task and background.

Contrast sensitivities were obtained for the wire with and without 40 footcandles of general illumination measured in the plane of the background. This actually added another 20 footlamberts to the brightness of the background at all steps.

The results have been plotted in Fig. 3 (Fig. 7 of the paper), C showing the contrast sensitivities without general illumination and D with it. For example, with back-lighting alone the contrast sensitivity is 12.5 when the background brightness is 40 footlamberts. When the general illumination is added, the contrast sensitivity drops to 10, although the background is now brighter by the addition of 20 footlamberts.

A study of Fig. 2 (Fig. 5 of the paper) indicates that a self-luminous background is greatly superior to a front-lighted one. For example, it would take a front-lighted background of 500-footlambert brightness to give as much contrast sensitivity as a

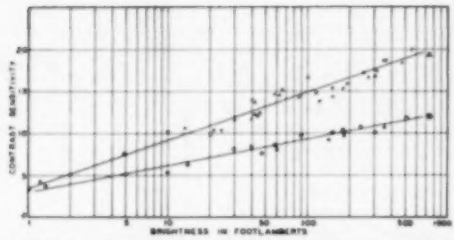


Figure 2. Wire No. 2 of experimental task. A—against self-luminous background. B—with front lighting and against white paper background.

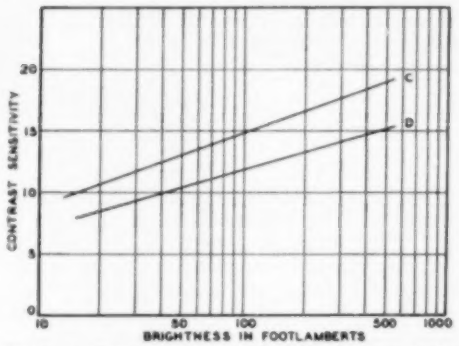


Figure 3. Wire No. 2 seen against self-luminous background. C—No front lighting. D—40 footcandles of front lighting.

21-footlambert brightness of the self-luminous background.

The importance of shielding the task as effectively as possible when viewing it against a self-luminous background is shown in Fig. 3 (Fig. 7 of the paper). It requires 400 footlamberts of background brightness with 40 footcandles of general illumination on the task to equal the contrast sensitivity of a 100-footlambert background when general illumination is excluded.

The following conclusions are indicated:

Fine wires can best be seen in silhouette against a self-luminous background.

The size of the background is not important from a standpoint of contrast sensitivity, but may become a source of some annoyance if it is very small.

Direct light should be excluded from the task insofar as possible.

For wires in diameters near 0.003 inch, and with most direct light excluded from the task, a self-luminous background brightness of 200 to 300 footlamberts will provide most of the attainable contrast sensitivity.

The author gratefully acknowledges the loan of the ingenious contrast sensitivity meter from Dr. C. L. Cottrell, of Cornell University, and thanks him for advice and instruction in its operation.

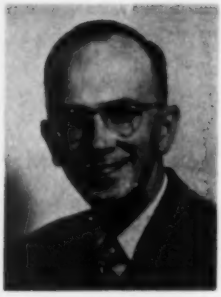
(Abstract of I.E.S. 1952 Conference Paper No. 3)

From the Sessions on

Sources and Circuits

A New Lead-Lag Ballast For Discharge Lamps

C. H. Burns



H. E. Bachman

THIS NEW ballast circuit, shown schematically in Fig. 1, offers practically all of the advantages and none of the disadvantages of existing circuits. From the analysis and from designs made to date, it appears to be applicable for use with all of the slimline and instant-start type lamps as well as with certain of the preheat type lamps. It has already been successfully used for operation of the 48T12, 72T12 and 96T12 slimline lamps at 425 milliamps and the 90-watt preheat type lamp.

As with its predecessor lead-lag design it possesses the advantages of stroboscopic correction, plus rapid transition through the starting phase and good wave shape for insurance of long lamp life. The data in Table I shows that lamp life on this new type ballast is comparable to that obtained on the conventional lead-lag ballast. As lamps are still burning on the new circuit it is expected that the comparison will be even more favorable when the test is completed.

This new design has the advantage of series sequence-start ballasts in that it is smaller in size in certain ratings, weighs less and has lower losses and cost than the conventional lead-lag ballast. The most serious shortcoming of the series sequence-start ballast is eliminated; namely, maintenance problems due to both lamps either completely extinguishing or glowing only faintly when one lamp fails, which results in loss of light output, and in some cases, the replacement of a good lamp. It is felt that for most applications this circuit offers all of the advantages and none of the disadvantages of existing ballast circuits.

AUTHORS: Ballast Section, Westinghouse Electric Corp., Cleveland, Ohio; and Lamp Engineering, Westinghouse Electric Corp., Bloomfield, N. J., respectively.

TABLE I.—Standard Cycle Test.
3 Hours On, 20 Minutes Off.

	NEW LEAD-LAG BALLAST		CONVENTIONAL LEAD-LAG BALLAST	
	Number of Lamps	Per Cent of Life on Conventional Ballast**	Number of Lamps	Per Cent of Average Life**
Lag Side ..	6*	90*	2*	100*
Lead Side .	5*	101*	3	100
Total	11		5	
Average		96		100

*One lamp still burning.
**Average life on conventional lead-lag ballast taken as 100%.

(Abstract of I.E.S. 1952 Conference Paper No. 14)

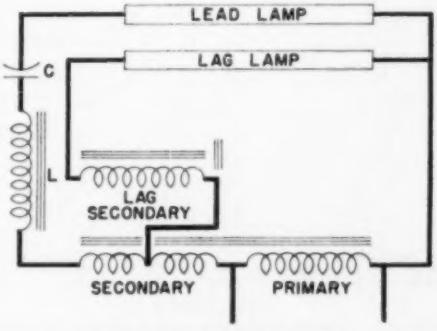


Figure 1. New lead-lag circuit.

George Meister

Thomas H. Heine

Low Pressure Mercury Discharges—III

Xenon-Argon, Xenon-Neon

IN TWO previous papers the effect of the rare gas mixtures krypton-argon, krypton-neon, and krypton-xenon on the characteristics of the low pressure mercury discharge was considered. This paper extends the information to mixtures of xenon-argon and xenon-neon.

The water-jacketed experimental discharge tube was provided with an ultraviolet-transmitting section and a phosphor-coated section which made it possible to measure simultaneously the ultraviolet, fluorescent, and visible outputs of the arc as the gas fill composition, pressure and arc current were varied. The 500 ma characteristics of the mercury discharge with krypton at 2 mm and 45C were taken as the 100 per cent reference point.

For all compositions of xenon-argon the voltage was lowest at 2 mm. The voltage for xenon at this pressure was 40 per cent lower than for argon and intermediate mixtures fell along a uniform curve of slight upward concavity. The voltage of xenon-neon mixtures containing more than 10 per cent xenon was lowest at 2 mm while for less than 10 per cent xenon the minimum shifted to 1 mm. The presence of 25 per cent neon at both these pressures has little effect (less than 5 per cent) but larger proportions caused a steep rise in voltage. At 2 mm the voltage with neon was approximately 90 per cent higher than the voltage with xenon.

The efficieny of the visible light output of the arc was highest at 1 mm for all mixtures of xenon-argon. A slight maximum was found at 20 per cent xenon - 80 per cent argon where the output efficiency was 1 per cent higher than for pure argon and 5 per cent higher than for pure xenon. As the gas pressure was increased to 5 mm the efficiency decreased 40 per cent with xenon while with argon the drop was only 15 per cent. Above 3 mm pressure the relationship of efficiency to composition was linear.

The arc efficiency of xenon-neon mixtures was highest at 1 mm for all compositions containing more than 8 per cent xenon. However, with neon the efficiency was greatest at 2 mm. A maximum

Authors: Westinghouse Electric Corp., Lamp Division, Bloomfield, N. J.

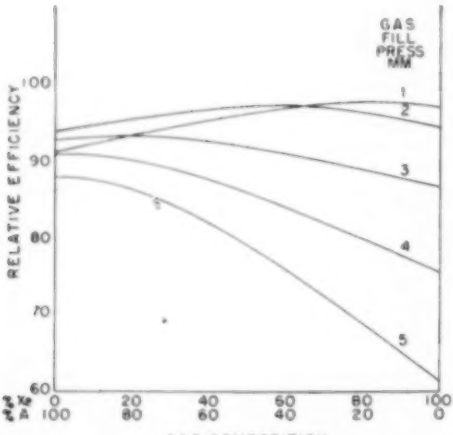


Figure 1. Relative ultraviolet output efficiency for mixtures of xenon and argon.

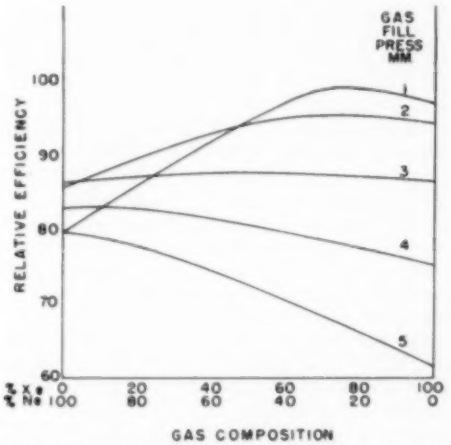


Figure 2. Relative ultraviolet output efficiency for mixtures of xenon and neon.

are efficiency was reached with 40 per cent xenon - 60 per cent neon at 1 mm pressure which was 9 per cent higher than pure xenon and 19 per cent higher than pure neon. As in the previous case the efficiency decreased as the pressure increased.

Fig. 1 shows that the ultraviolet output efficiency for mixtures of xenon-argon was highest at 1 mm for mixtures containing more than 65 per cent xenon and was highest at 2 mm for less than 65 per cent xenon. The efficiency at 2 mm pressure reached a maximum at approximately 50 per cent xenon - 50 per cent argon. This composition corresponds to the optimum mixture reported for krypton-argon.

Fig. 2 shows a pronounced maximum ultraviolet output efficiency for 75 per cent xenon - 25 per cent neon at 1 mm which corresponds to the previously reported optimum mixture of krypton-neon. For mixtures containing less than 50 per cent xenon the highest efficiency occurred at 2 mm and then shifted to 3 mm for pure neon. It is interesting to note that the efficiency at 3 mm is practically constant for all gas compositions.

The fluorescent output efficiency followed the pattern of the ultraviolet efficiency curves and verified the maximum efficiency points of 50 per cent xenon - 50 per cent argon at 2 mm and 75 per cent xenon - 25 per cent neon at 1 mm.

(Abstract of I.E.S. 1952 Conference Paper No. 5)

Reflectorized Mercury Lamps And Their Industrial Applications

E. B. Noel

E. A. Linsday

FOUR mercury lamps are now available with integral reflectors. They are the 100-watt flood H100-FL4, the 100-watt spot H100-SP4, the 400-watt H400-R1, and 400-watt color improved H400-RC1. The 100-watt lamps are in PAR-38 bulbs; the 400-watt lamps are in R-52 bulbs. Dimensions and characteristics are given in Table I.

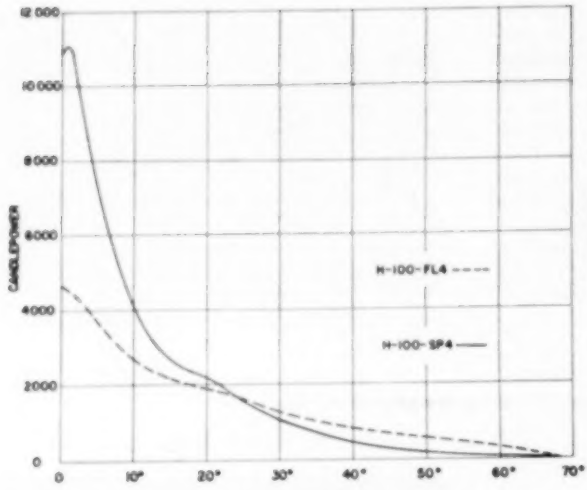
The 100-watt lamps use a new type of mechanically made pinch seal in an all-quartz arc tube that provides improved performance and reliability. The leads are molybdenum wires, in the center of which a flat section 0.0006" thick has been rolled. These rolled leads are placed in the open end of the quartz tube where they are protected by an inert gas while the quartz is heated and pinched around them. In some extreme applications where older

AUTHORS: Lamp Development Laboratory and Application Engineering Department, respectively, of the Lamp Division, General Electric Co., Nela Park, Cleveland, Ohio.

TABLE I.—Reflectorized Mercury Lamps.

Lamp	H100-FL4	H100-SP4	H400-R1	H400-RC1
Wattage	100	100	400	400
Initial Lumens	2300	2300	16,000*	12,300*
Approx. Mean Lumens for 3000 hrs. Life	—	—	14,000	10,700
Approx. Mean Lumens for 4000 hrs. Life	—	—	13,400	10,300
Rated Life at 5 hours per start	1000	1000	3000	3000
Rated Life at 10 hours per start	—	—	4000	4000
Bulb	PAR-38	PAR-38	R-52	R-52
Base	Admedium skirted	Admedium skirted	Mogul Mechanical	Mogul Mechanical
Burning Position	Any	Any	Any	Any
Max. O.A.L.	5¼"	5¼"	11¼"	11¼"
Lamp Operating Volts	130	130	135	135
Approx. Lamp Starting Current	1.3	1.3	5.0	5.0
Lamp Operating Current	.9	.9	3.2	3.2
Time to full output on lag circuits	3-8 min.	3-8 min.	5	5
Cooling time to restart on lag circuits	3-8 min.	3-8 min.	4	4

*Illumination calculations should be based on 20,000 lumens which are the generated lumens from an H400-E1 source.



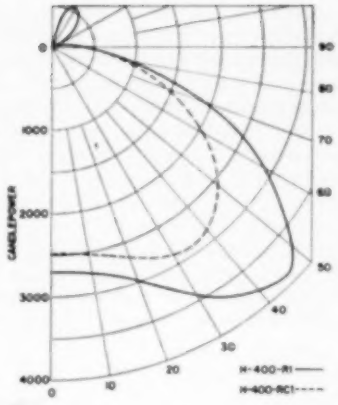


Figure 1a. (left) Distribution of 100-watt PAR-38 mercury lamps. The curves show the candlepower distribution of the spot and flood types. The distribution of near ultraviolet radiation follows the same pattern.

Figure 1b. (right) Distribution of the 400-watt R-52 mercury lamps. The curves show the candlepower distribution of the total visible radiation of the H400-R1 and H400-RC1 mercury lamps. The upward light is the same for both lamps.

type glass seal arc tubes were failing at around 350 hours, lamps with pinch seals ran 2000 hours or more.

Pinch seals also have been developed for the 400-watt lamps, and are in use in a portion of the 400-watt production.

With the R-52 bulbs it is necessary to use a heavy frost to avoid concentration of reflected energy on the arc tube and on the bulb face. For color improvement a red emitting phosphor was first applied to the R-52 bulb face, but low light output and poor distribution resulted. By coating only the reflector surface, 20 to 25 per cent more output was obtained and the distribution was greatly improved. The distributions of the 100-watt and 400-watt lamps are shown in Figs. 1a and 1b, respectively.

Application of Reflectorized Mercury Lamps.— The 100-watt PAR-38 lamps are intended primarily for use as sources of "black light." The applications vary all the way from the spectacular theatrical uses to laboratory photosynthesis. Probably the most familiar application is the inspection of metal parts for cracks by means of a penetrating fluid and fluorescent powder.

Many materials fluoresce naturally. For examples oil leaks in mechanisms can easily be detected by blacklight inspection. In some cases a fluorescent additive is used. This is often the case in sorting and identification applications, or when inspection is made for otherwise undetectable residues.

The 400-watt R-52 lamps are intended for general lighting service. They have the basic advantage of all reflector lamps in that lumen depreciation is markedly reduced because of the built-in reflector, and the very limited amount of dirt which can collect on the bulb face when the lamp is mounted base up. In the dirtiest environments, for every 1000 hours of service, tests indicate less than 2 per cent reduction due to collected dirt.

The R-52 bulbs are designed for wide candlepower distribution which allows spacings of lamps equal to mounting height while still providing good uniformity of illumination. Operation in fixtures is the preferred method of utilization because of the relatively high brightness in the zone between 60° and 90°, as Fig. 1b shows. The reflector intercepts this high angle light, and redirects it into zones below 60°. Reflector mercury lamps have been installed in several types of equipment designed for high mounting. The results were quite comfortable, and maintenance factors of over .75 were obtained.

In many areas where higher wattage mercury lamps are unsuitable, it is especially noteworthy that the H400-R1 provides light at the lowest overall cost.

(Abstract of I.E.S. 1952 Conference Paper No.13)

New Fluorescent Lamp and Ballast Design for Rapid Starting

A. E. Lemmers

W. W. Brooks

THIS NEW rapid-starting fluorescent lamp and ballast system offers the lighting industry high quality, rapid-starting, fluorescent lighting with considerable reduction in ballast material. It has been developed by taking advantage of certain lamp characteristics to make a new lamp and a ballast which are integrated.

This was accomplished by determining for many lamp sizes the complex inter-relation between lamps and ballasts. From this determination changes in lamp characteristics which reduced starting voltage were most effective in reducing ballast material. A summary of one phase of this investigation is shown in Fig. 1. The curve "A" of Fig. 1 shows how lamp starting voltage is reduced by supplying heating current to the cathodes of the lamp. According to curve "B," starting voltage was further reduced by adding to the lamp a starting aid in the form of a conductive strip two to three millimeters in width. Starting voltage was still further reduced as shown by curve "C," when the conductive strip was connected to one cathode of the lamp. The effect of a grounded fixture is shown by curve "D." However, using existing lamps this lowering of starting voltage by supplying pre-heating current to the lamp cathodes costs about 6 watts per cathode. Since such an increase in power supplied to the lamp was intolerable, it was necessary to find a more efficient way to obtain the very desirable reduction in starting voltage resulting from supplying cathode heat. In making that search, our work proceeded in two directions: first, the development of new cathode-preheating ballasts for existing lamps, second, the development of new lamps with special cathodes.

Work in the direction of applying these techniques to existing lamps showed that two conditions prevented obtaining all of the potential reduction in ballast material. One was the loss of the effect of the grounded fixture under humid conditions. The other was the size of the ballast element necessary to adequately reduce cathode heating current after lamp starting.

Since all of the inherent advantages in these techniques could not be exploited by using existing lamps, a new lamp was designed.

Again referring to the curves on Fig. 1 it is apparent that all of the starting aids have the effect of reducing the cathode heat required to obtain the greatest reduction in starting volts. The choice of one of these starting aids for the new lamp was made; first, by whether it reduced the starting voltage to sufficiently reduce the ballast materials,

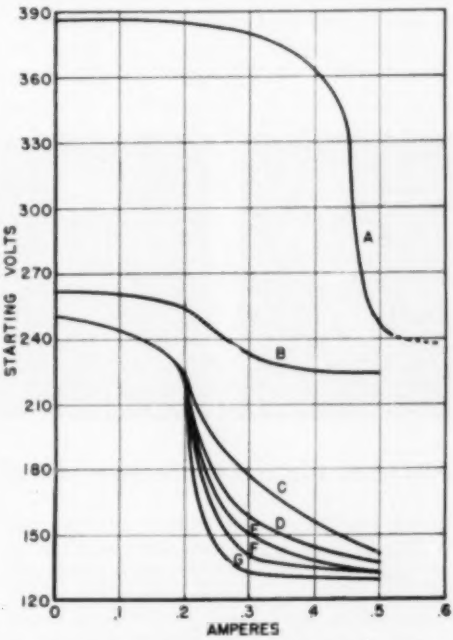


Figure 1. These curves show how cathode heat and starting aids are related and how they lower starting volts in 40-watt T12 lamps.

AUTHORS: General Electric Co., Lamp Development Laboratory, Cleveland, Ohio; and General Electric Co., Ballast Engineering Div., Fort Wayne, Indiana, respectively.

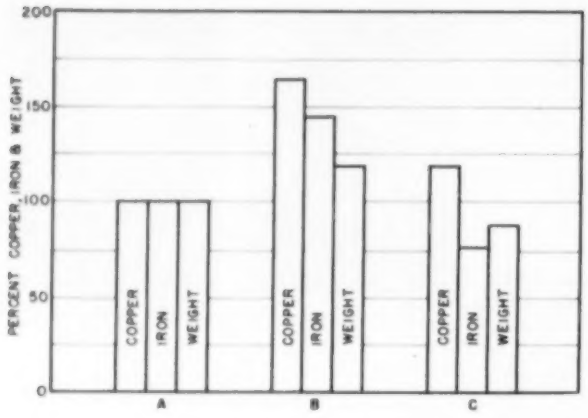


Figure 2. Bar graph of relative copper, iron, and total weights for three 40-watt two-lamp commercial ballasts. A is a standard switch-start type ballast. B is a series instant-start and C is the new rapid-start ballast.

and second, by whether it resulted in minimum lamp cost. This approach to the design of the new 40-watt lamp resulted in the selection of the grounded fixture starting aid. However, in order not to lose this starting aid under high humidity conditions, it was necessary to coat the lamp with a water repellent material.

One other very desirable feature of the new lamp remained to be obtained. That was minimizing the increase in lamp input power due to cathode heating current. Fortunately, the use of short cathodes reduced it to insignificance.

Lamps made as outlined and operated in appropriate systems yielded rated lumen output and life, with fast starting. Also, compared to switch-start, ballast input watts increased from 0 to 5 per cent and material and weight were reduced significantly (Fig. 2).

(Abstract of I.E.S. 1952 Conference Paper No. 15)

Left to right

J. H. Campbell

H. E. Schultz

D. D. Kershaw

Characteristics and Applications of High-Frequency Fluorescent Lighting

THIS PAPER provides information on the high frequency operation of several types of fluorescent lamps over a range of 60 cycles to 20,000 cycles for a sine wave type of power supply. Included is a comparative test analysis of 360-cycle square wave operation such as provided by the magnetic frequency converter.

AUTHORS: General Electric Co., Nela Park, Cleveland, Ohio.

Lamp Efficiency vs. Frequency.—Fig. 1 illustrates lamp efficiency in terms of lumens per watt over a frequency range of 60 to 20,000 cycles. Ballast for the 60-cycle reference point is the conventional series inductive reactance, while all ballasts for higher frequencies are capacitor ballasts. Referring to the 40-watt T-12 curve, an increase from 59 lpw at 60 cycles to 65 lpw at 7,000 cycles is

accomplished with a sine wave at rated lamp watts.

Power at 7,000 cycles is difficult to obtain and special wiring would be required for distribution to the lamp load. Fig. 2 shows how the same order of lamp efficiency increase is obtained with a 40-watt lamp at a frequency of only 360 cycles. The square current wave produced by the magnetic frequency converter is largely responsible for the increased efficiency.

Relative Lumen Output vs. Lamp Current.—Fig. 3 shows how lumen output of a 40-watt lamp can be raised by increasing lamp current. The application of these data as they pertain to operation of fluorescent lamps at higher current densities will be influenced by other factors which have not been fully determined. Such factors are: lamp life, lumen maintenance and ambient temperatures.

The Magnetic Frequency Converter.—The most recent application of high frequency fluorescent lighting involves the use of a magnetic frequency converter without moving parts. As a method of converting 60 cycles to 360 cycles, the equipment, now in the early stages of design, has several advantages and limitations as follows:

Converter Advantages

1. Low maintenance
2. Produces square current wave
3. Output current can be regulated
4. Converter can be located in transformer vault
5. High efficiency (approximately 75 per cent)

Converter Limitations

1. Requires 3-phase power input
2. Total weight somewhat greater than 60-cycle ballasts
3. Operation optimum at full load
4. Initial cost higher than 60 cycles

360-Cycle System Advantages

1. Lighter weight fixtures
2. Less heat loss at fixture
3. More lumen output per lamp
4. Lumen output can be regulated
5. Lighting installation silent in operation
6. Reduced stroboscopic effect

Summary.—While most all of the characteristics of high frequency lighting are desirable for general applications, the economics of frequency conversion must be improved to justify widespread use. Meanwhile in some special applications the system desirability is sufficient to warrant applications now.

In the opinion of the authors sufficient progress has been made since the last report to improve the status of high frequency lighting from one of possibility to one of strong probability.

(Abstract of I.E.S. 1952 Conference Paper No. 16)

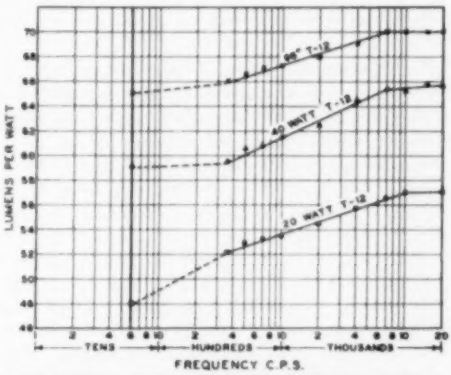


Figure 1. Lamp efficiency vs. frequency for constant lamp watts plotted according to bulb diameter. Standard Cool White lamps were used throughout the tests. The T12 family of lamps operated at the following line voltages: 96T12 at 600v; 40-watt T12 at 400v; 20-watt at 120v.

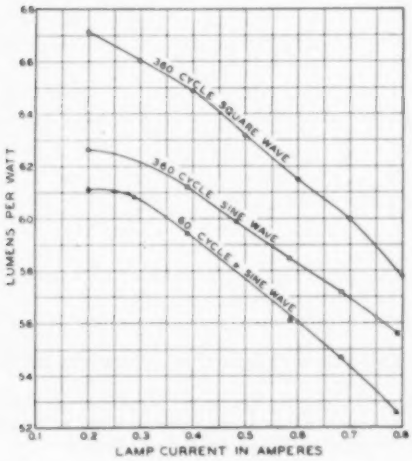


Figure 2. (left) Square current wave and sine wave 40-watt T12 lamp characteristics. Lamp efficiency vs. lamp current.

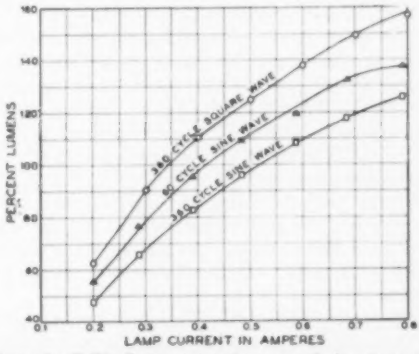


Figure 3. (above) Square current wave and sine wave 40-watt T12 lamp characteristics. Relative lumen output vs. lamp current.

Left to right

A. C. Barr

C. N. Clark

Joan Hessler

Evaluation of Color Rendition By Fluorescent Lamps—An Exploratory Study

THERE is an increasing critical interest in color. The recently introduced de luxe and standard cool white fluorescent lamps may look alike while differing markedly in their color rendering properties; so, too, may the de luxe and standard warm white. This further emphasizes the need for a method of designating the color-rendering qualities of the various so-called white light sources.

An experimental objective evaluation was accordingly undertaken in an attempt to develop a workable system. Black body radiators at 2854K and 4400K (approximately the chromaticities of the warm and cool white fluorescent test sources) were assumed to represent ideal color-rendering sources at their respective "white points." The chromaticity shifts of twenty selected colors, from black body to fluorescent test source illumination, when plotted on the Rectangular Uniform Chromaticity Scale diagram (RUCS),[1] were used as a measure of the color distortion introduced by each test source.

The colors selected are modified Munsell colors of about 6/6 value and chroma. They were modified to fall in a circle around the equal-energy point on the RUCS diagram when lighted by an equal-energy source (Fig. 1). The color shifts of each of the 20 colors from black body to test-source illumination are shown in Figs. 2 and 3.

Several methods of reducing these color shifts to a single number representing over-all color rendition were investigated. The results are given in Table I, together with those of earlier studies by Jerome and Judd[2] and by Harrison.[3]

The color-rendition factors given in line B appear most closely to approximate over-all color rendition effects. Yet, they do not relate closely enough to visual experience to be considered wholly satisfactory. Subjective appraisal indicates greater superiority for a special de luxe cool white over the de luxe cool white than the factors indicate, while in the case of the de luxe warm whites there is less difference than indicated. Further, there is no assurance that the factors are in a true percentage relationship to each other in the subjective sense;

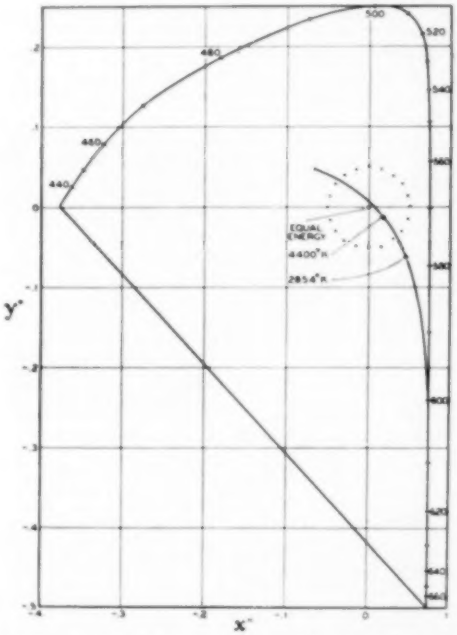


Figure 1. Chromaticities of 20-hue series illuminated by equal energy light source, plotted on the Rectangular Uniform-Chromaticity-Scale diagram.

AUTHORS: Application Engineering Department, Lamp Division General Electric Company, Nela Park, Cleveland, Ohio. Miss Hessler is now a graduate student at the Massachusetts Institute of Technology.

TABLE I.—Color Rendition Factors.

Evaluation Method	Formula	Fluorescent Lamps Tested					
		Standard Warm White	Deluxe Warm White	Special Deluxe Warm White	Standard Cool White	Deluxe Cool White	Special Deluxe Cool White
A. Deviation Related to Saturation of Comparison Standard	$1 - \frac{\Sigma \Delta}{\Sigma R_{(\text{Comparison Std.})}}$	.65	.72	.81	.82	.91	.91
B. Deviation Related to Saturation of Each Test Source	$1 - \frac{\Sigma \Delta}{\Sigma R_{(\text{Test})}}$	.55	.74	.81	.80	.91	.91
C. Weighted Deviation Related to Saturation of Each Test Source	$1 - \frac{\Sigma (100\,\Delta)^2}{100 \Sigma R_{(\text{Test})}}$	.22	.63	.83	.79	.96	.95
Duplication Index (Jerome & Judd)		.45	.54	.69	.58	.76	.69
Figure of Merit (Harrison)		.60	.73	.78	.67	.83	.75

Δ—Deviation, test source color point from standard source color point, in RUCS units.
R—Radius from white point to color point, in RUCS units.

the sensation scale is not likely to be linear and no point of zero color rendition is defined. It can be said, however, that the factors are more closely representative of subjective experience than others so far suggested.

Discrepancies with subjective experience are apparently due largely to lack of data on psychological effects. At present it is not known whether color shifts in all directions are equally undesirable or by what factor larger shifts should be weighted

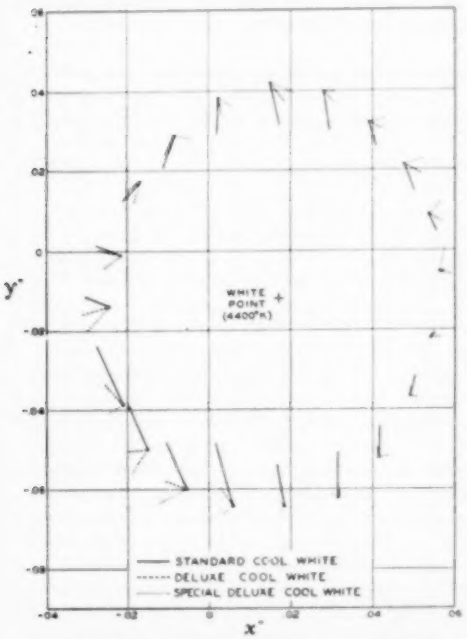


Figure 2. Color Rendition Patterns — Cool Whites.

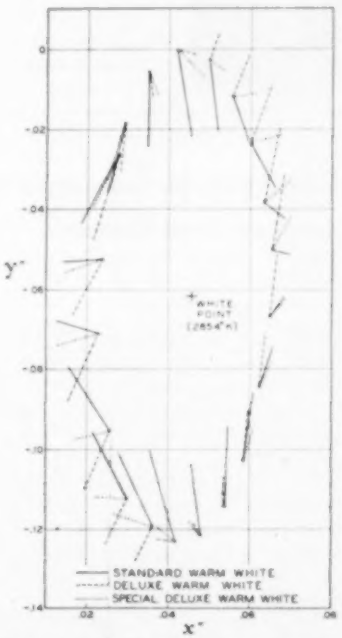


Figure 3. Color Rendition Patterns — Warm Whites.

The points indicate the chromaticities of the 20-hue series illuminated by the black-body comparison standard. Thus, by definition, they represent optimum color rendition. Length and direction of the lines indicate magnitude and direction of color shift introduced by the various fluorescent lamps.

relative to smaller ones. Nor is there any assurance that equal color shifts in different spectral regions will have equal effect on over-all color rendition.

Subjective color studies are needed, supplementing that reported by Commery and Leighton.[4] However, in addition to reporting change of appearance, they should evaluate the psychological effect of color change in terms of preferability. This would provide the basis for weighting color shifts in various hue regions. Integrated with the work reported in the paper, the result would be realistic color rendition factors capable of standing the final test of subjective appraisal.

References

1. Brockenridge, F. C., and Schaub, W. R.: "Rectangular Uniform-Chromaticity-Scale Coordinates," *Journal of the Optical Society of America*, Vol. 29, p. 370 (September 1939).

2. Jerome, C. W., and Judd, D. B.: "Specification of Color Rendering Properties of Fluorescent Lamps," Preprint No. 4 of a paper presented at the National Technical Conference of the I.E.S. (August 1950).

3. Harrison, W.: "Assessment of Colour Rendering Properties of Fluorescent Lamps," *Light and Lighting*, p. 148 (April 1951).

4. Commery, E. W., and Leighton, Kaye A.: "Fluorescent Lighting in the Home — Part 1," ILLUMINATING ENGINEERING, Vol. XLV, No. 12, p. 743 (December 1950).

(Abstract of I.E.S. 1952 Conference Paper No. 7)

Erwin F. Lowry

The Physical Basis for Some Aspects Of Fluorescent Lamp Behavior

FLUORESCENT lamp parameters have been improved to such an extent during the past few years that a discussion of current data seems advisable. Various characteristics of these lamps can now be correlated on a sound physical basis.

Lamp Efficiency.—It is demonstrated in the figure that the total lumens emitted by various lamps of the same color and loading are directly proportional to their effective watts. The slope of the line (P) represents the efficiency to be expected from a lamp of infinite length. In such a lamp, obviously, the electrode losses would be negligible.

The relative efficiencies of lamps of different colors have been calculated from their respective Spectral Energy Distribution curves by multiplying the energy radiated at each wavelength $J\lambda$ by the standard luminosity factor for that wavelength $K\lambda$ and adding the results, to which are further added the contributions made by the various visible mercury lines. Comparison with measured lpw values shows good agrement between calculated and observed values.

Lumen Maintenance. — Recent measurements have served to further establish the validity of the lumen maintenance equation proposed by the author some years ago.

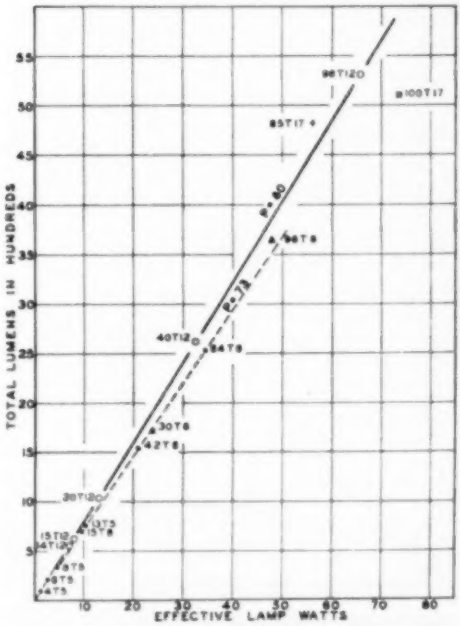


Figure 1. Lumen output of white fluorescent lamps as a function of arc watts.

AUTHOR: Sylvania Electric Products, Inc., Salem, Mass.

This equation was:

$$L_o - L_T = A(1-e^{-aT}) + B(1-e^{-bT}) + C(1-e^{-cT})$$

where L_o = initial efficiency in lumens per watt
L_T = efficiency after T hours of operation
T = operating time in 100's of hours
A, B, and C are quantities having the dimensions of lumens per watt
and a, b, and c are constants.

The measurements involved in the present paper were carried out on lamps containing halo-phosphate phosphors whereas the previous work was done using zinc-beryllium-silicate phosphors.

In studying the maintenance curves for lamps of various colors and loadings, it was found that the dimensions of the coefficients were dependent upon the phosphor color and the exponents were proportional to lamp loading. In other words, the amount of depreciation in lpw, other things being equal, is determined by the relative efficiencies as calculated from the SED curves discussed in the previous section; the rate at which this depreciation takes place is directly proportional to lamp loading in watts per unit phosphor area.

Lamp Life.—As the result of improved cathode design and formulation, the expected life of most fluorescent lamps is now about 7500 hours. Since fluorescent lamps, in common with other light sources, have an efficiency depreciation with continuing operation, there comes a time when further operation of the lamp becomes uneconomical. It turns out that the most economical operating life of present day 40-watt lamps, for example, is about 6000 hours. On the basis of a normal mortality curve, lamp life for any duty cycle of three hours or more is, therefore, now greater than necessary to attain most economical operation.

(Abstract of I.E.S. 1952 Conference Paper No. 6)

President Hibben's Address (continued)

majority of our members; hence my recommendation that it be given every possible support through news contributions, photographs and current happenings of importance fed to the Editor's desk at Headquarters.

Publicity, and public relations is a never-ending, never-sleeping task! We have recently given it emphasis, but not too much. Our second "Lighting Handbook" is a valuable tool that this administration has sold to the approximately number of 7000. In 1912, the I.E.S. copyrighted its first special major publication, "The Lighting Primer." It seems timely to issue another "Primer," geared to the understanding of the average citizen and for bulk sale. Remember, each year in the United States alone, one million new citizens have not given light more than a passing thought!

Some considerable emphasis must be placed upon our Society's activities, specifically directed towards the care and preservation of human eyesight. One vital argument in favor of the expansion and strengthening of Society influence comes from the increased burdens placed upon the seeing organs in a civilization that uses vision with an increasing tempo. It is a red flag of warning to note that one school child out of six cannot naturally see well enough to learn properly and that more or less as a result of faulty vision, our school children suffer some 85,000 eye mishaps a year. It is challenging to note that more than 20 per cent of the young men of this nation called for military duty cannot, without "eye-crutches," see well enough to fire a rifle or read an instrument or to observe a night signal! Color blindness is an insidiously alarming thing for the motorist and the worker. Every single day, in the U. S., there are 700 new people who need to be told how to avoid glare and gloom. This includes the use of daylight as well. There is no criticism of beauty — rather of science — that each year Americans spend five million dollars on eye cosmetics — and less than one million dollars on medical eye research! And in putting on the warm garments of humanism, our Society in this work to prevent loss of see-ability is surely dedicated to one of its finest tasks!

It should be obvious that where knowledge of good lighting — and then its practice — expand, the growth of good business is inevitable. Our Society does not appraise its work in terms of dollars —but it is not an accidental coincidence that sales of kilowatt-hours for lighting, or of luminaires and accessories, have risen in a curve that almost exactly duplicates the growth of our membership! It is not surprising that the installed generating capacity in this country has grown from about six million kilowatts in 1906 (when the I.E.S. was founded) to last year's figure of nearly 100 million! Or that the cost of far more liberal light today is 90 per cent of what it was two decades ago, contrasted to general living costs that have much more than doubled! So our Society is building business — good business! The end is not in sight.

Yes, there is still much to be done! Our Society has the framework and the reputation and the confidence of Industry. It must "think big." It must recognize its responsibilities over an ever-increasing area where science and business blended with humanitarianism will challenge and defeat the forces of darkness.

From the Session on

Daylighting

Left to right

J. W. Griffith

O. F. Wenzler

E. W. Conover

The Importance of Ground Reflection in Daylighting

DAYLIGHT reflected from the ground contributes considerably to the illumination in a room. Consequently, the assumption that daylight arrives at a window directly from the sky only is basically in error, and daylighting design as well as daylighting prediction methods should take into account this reflected light.

The amount of reflected light depends on the light incident on the ground and the ground reflectance. The incident light varies in intensity with sky brightness pattern and position of the sun. Ground reflectance also varies from about 10 per cent to almost 100 per cent, with values from 15 to 50 per cent being most common.

An indication of the contribution of light from ground reflections is shown by computations for several typical conditions in Table I (Table II of the paper). This table is computed on the basis of an overcast sky having an equivalent brightness of 1000 footlamberts, which has been employed for many years as the basis of daylight prediction methods. The contribution from below the horizontal ranges from 9 to 33 per cent of the total incident light for the overcast sky and range of ground reflectances shown.

AUTHORS: Research Associate, Southern Methodist University, Dallas, Texas; Manager Sales Technical Service, Libbey-Owens-Ford Glass Company, Toledo, Ohio; and Research Engineer, Detroit Steel Products Company, Detroit, Michigan, respectively.

This light reflected from the ground is indirect light in a room as it reaches the work plane by interreflectance from the ceiling and walls. It improves the uniformity of the illumination in the room and it improves the brightness ratios.

Table II (Table III of the paper) shows the maximum, average, and minimum readings of illu-

TABLE I.—Illumination Incident on Vertical Windows From Uniformly Overcast Sky Plus Ground Reflections.

Per Cent Ground Reflectance	10	20	30	40	50
Incident Illumination from Uniform Sky Only (Ft-c)	500	500	500	500	500
Incident Illumination from Ground Only (Ft-c)	50	100	150	200	250
Total Incident Illumination from Sky plus Ground (Ft-c)	550	600	650	700	750
Incident Illumination from Ground Only — % of Total	9.1	16.7	23.1	28.6	33.3

TABLE II.—Interior Illumination from Ground Light Only.

Vertical Illumination	100 Footcandles			150 Footcandles			250 Footcandles		
	Work Plane Illumination								
Reflection Factors*	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.
30-50-85	16.4	9.6	4.4	24.6	14.4	6.6	41	24	11
30-70-85	17.4	10.8	5.8	26.1	16.2	8.7	43.5	27	14.5
30-50-70	16.2	9.0	4.2	24.3	13.5	6.3	40.5	22.5	10.5
30-70-70	18.0	10.4	5.6	27.0	15.6	8.4	45	26	14

*Of floor, walls, and ceiling, in that order.

mination on the work plane of a typical room with light coming from the ground only. These readings were taken at Southern Methodist University in a one-fourth scale model representing a 30 x 30 x 12-foot room. This series of tests had all of the incident light from the ground. The fenestration was clear glass extending from wall to wall and from a 36-inch sill to the ceiling, and corrections have been introduced for the effect of the mullions and muntin bars typical of metal window construction. Data are shown for varying reflectances of ceiling and walls.

Values computed from actual test results are shown for 100, 150, and 250 footcandles incident on the window from the ground alone. These represent the ground light which would be received for typical ground reflectances of 20, 30, and 50 per cent, representative of grass, gravel, and concrete, respectively, if these grounds were illuminated by the 1000-footlambert uniformly overcast sky. Light received from the ground for other conditions would be proportional the average ground brightness.

It has been common practice to use a reading of the total light incident on a vertical fenestration as a basis for comparison of daylighting test results. Such a procedure does more than just neglect the added light available from the ground. It actually penalizes the installations with higher ground reflections for their more effective utilization of light. A fairer comparison could be made by using an overcast sky having an equivalent brightness of 1000 footlamberts as a basis rather than adjusting to 500 footcandles incident on the window.

Light from below the horizon is bonus light. It is a dividend from something whose only cost is good design practice.

(Abstract of I.E.S. 1952 Conference Paper No. 10)

Controlling and Redirecting Daylight By Means of Louvers

Hempstead S. Bull

THIS PAPER describes the procedure and summarizes the results of a research project carried on at the University of Michigan under the sponsorship of the Illuminating Engineering Society and financed by its Research Trust Fund.

A typical schoolroom, one-fourth natural size, was set up in the laboratory and exposed to simulated skylight and sunlight of various brightness patterns. For each chosen sky composition the effects of various louver arrangements in the window opening on the brightness and footcandle patterns within the room were accurately measured.

The first natural lighting condition to be simulated was an overcast sky with maximum brightness at the zenith, tapering to about 33 per cent of maximum at the horizon. With this brightness pattern held constant the light controlling properties of two louver systems in the window opening, one with horizontal blades and the other with vertical blades, were determined for several angles of tilt.

The light sources were then rearranged to simulate an overcast sky with uniform brightness and the effects of the two systems of louvers on the illumination and brightness patterns within the room were evaluated.

Similar studies under simulated direct sunlight, produced by a battery of projector spots, were made for two different angles of incidence and the results, properly weighted, were combined with the uniform sky series to obtain data which are believed to measure approximately the results to be expected with natural blue sky plus direct sunlight.

Some data were also obtained showing the effects of high-reflectance and low-reflectance foregrounds on the illumination and brightness patterns within the room.

The results indicate that either horizontal or vertical louvers may be used to good advantage in rooms having northern exposure. Horizontal louvers, tilted slightly, give a better footcandle distribution, but the control of brightness is in general better done by vertical louvers. For rooms having other than northern exposure the control device offering adequate brightness control with a minimum amount of reduction in footcandles consists of a horizontal louver system with the lowest set of blades tilted slightly and all the upper blades set parallel to the floor.

(Abstract of I.E.S. 1952 Conference Paper No. 11)

AUTHOR: Dept. of Electrical Engineering, University of Michigan, Ann Arbor, Mich.

Left to right

W. H. Billhartz

H. F. Kingsbury

R. W. McKinley

A New Daylighting Survey Technique Utilizing a Photographic Recorder and Physical Brightness Meters

CAREFULLY conducted daylighting surveys require a different technique from that ordinarily used in making electric lighting surveys. Interior illumination and brightness vary considerably and for the most part in direct proportion to the exterior illumination on the fenestration. They are also affected by the ratio of fenestration area to floor area and by the interior surfaces reflectances.

Since the exterior conditions are constantly changing, it is usually desirable to conduct a daylighting survey as quickly as possible to offset the effects of these changes.

The essential instrumentation for a daylighting survey consists of a means for measuring the exterior illumination and the interior illumination and brightnesses at various points. The usual instrumentation consists of one meter for exterior illumination, one for interior illumination, which is moved about, and one brightness meter which is also moved. Care must be taken to read all these instruments simultaneously.

To overcome these difficulties a photographic means for recording, simultaneously, the readings of a number of brightness and illumination stations has been developed. Twenty or more photoelectric cells are placed at various positions in the room to measure interior illumination with one or more placed outside to measure exterior illumination. At those positions where brightness readings are desired the illumination falling on the surface and the diffuse surface reflectance are measured. Multiplying these two together gives diffuse brightness of the surface. Fenestration brightnesses are mea-

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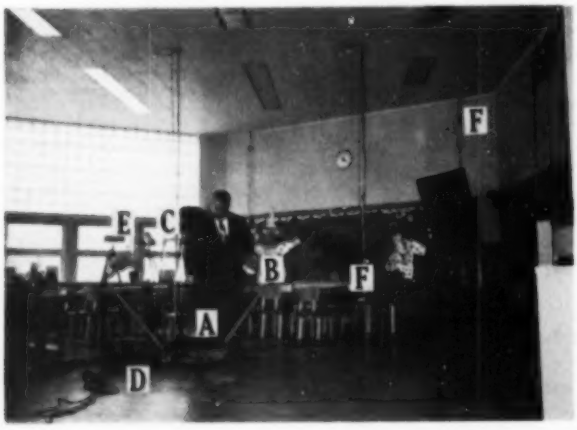

Figure 1. Photo Recorder set up in classroom at Stockton School, East Orange, New Jersey: A. Illumination and brightness meter panel, B. Flash lamp, C. Camera, D. Timer, E. Physical brightness meter, F. Photocells.

sured by physical brightness meters whose indicators are photographed along with the meters connected to the photo cells.

The essential components of this system are stable photoelectric cells, a panel of micro-ammeters connected to the photocells, an automatic camera to photograph the meter panel, strobe-lights to illuminate the meter panel instantaneously and a timer to control the frequency of photographic records. The equipment is shown in operation in a classroom. (See Fig. 1.)

It is recognized that the investment represented in the photo recorder and accessory equipment is too great for those who have only occasional need for such equipment. For those individuals a simplified version of the photo recorder retaining the essential elements and advantages of the larger unit is described. This unit may be assembled for under $200.

(Abstract of I.E.S. 1952 Conference Paper No. 12)

The Attainment of Quality Daylighting in School Classrooms

R. A. Boyd

THE ATTAINMENT of quality daylighting in school classrooms is largely dependent upon the reflectance of the room surfaces. This paper presents additional information on the importance of room decoration when the room is fenestrated with light-directing glass block.

The results presented in this paper were collected

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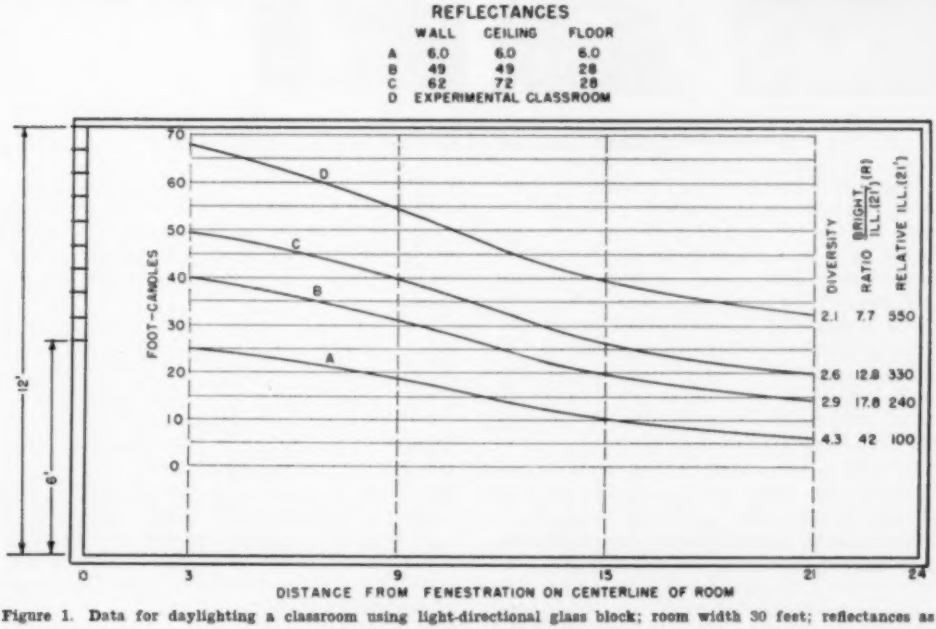

Figure 1. Data for daylighting a classroom using light-directional glass block; room width 30 feet; reflectances as indicated. 1000 ft-c, overcast sky.

through the use of a one-ninth scale model with the artificial overcast sky that is a part of the Daylighting Laboratory. This model represents a room 30 feet wide, with ceiling height of 12 feet and depths adjustable to 24 or 30 feet. The equivalent fenestration extended from six feet above the floor to the ceiling and the entire width of the room and consisted of five 8-inch light-directing glass block. It has removable ceiling, floor and wall panels with reflectances of 6, 10, 16, 28, 38, 49, 62, 77 and 88 per cent. Also, one set of panels was used having the same decoration as the experimental classroom of the Laboratory in order to check the data comparatively.

Typical data are shown by Fig. 1 (Fig. 2 of the paper). These give the distribution of light over the working plane, the diversity of the task illumination, the ratio of maximum fenestration brightness to the task illumination at the 21-foot station and the increase of illumination at the 21-foot station due to scattered light in a room that is 24 feet deep for an exterior illumination of 1000 footcandles due to overcast sky. This is the illumination due to light transmitted by the light-directing block only; the usual vision strip being omitted. These data are presented for four distinctly different decorations.

Similar data are presented for a room having a depth of 30 feet. The change of the quality of the daylighting with room surface reflectance is graphically presented for both room depths.

Additional data show the advantages of a bilateral fenestration arrangement and performance for direct sunlight conditions.

(Abstract of I.E.S. 1952 Conference Paper No. 8)

Left to right

R. L. Biesele, Jr.

W. J. Arner

E. W. Conover

A Lumen Method of Daylighting Design

THIS PAPER presents the basis of a new method of predicting the daylighting for interiors. Prior methods of daylight prediction have been limited in their application by the assumptions made in their development and have been applicable generally to large spaces such as industrial plants, in which interior inter-reflections and exterior ground reflections had little significance. This method is applicable to smaller spaces such as classrooms, offices, hospital rooms, small industrial spaces, and the like, in which interior reflections and ground reflections are significant.

It is simple to use and employs a computation technique with which most illuminating engineers and many architects are familiar. It recognizes the difference in sky pattern between overcast and clear skies and provides for the fact that light has a different interior distribution for these different patterns of sky illumination. The contribution from ground reflections is treated separately from that coming directly from the sky. An example of the use of the method is worked out in detail, step by step.

Besides its simplicity, by interpolation and extrapolation it is applicable to an almost infinite number of room sizes and shapes and window arrangements. It may be possible with further study to extend the method for almost any desired type of fenestration and controls. With the method, computations can be made for any time of day or year, in any locality, for any orientation, and for any special or unusual conditions under consideration.

In short, it is a general method of daylighting prediction and design which should prove widely useful in the architectural and engineering design of daylighted buildings.

(Abstract of I.E.S. 1952 Conference Paper No. 9)

AUTHORS: Southern Methodist University, Dallas, Texas; Libbey Owens Ford Glass Company, Toledo, Ohio; Detroit Steel Products Company, Detroit, Michigan, respectively.

From the Session on

Outdoor Lighting

Pavement Brightness Measurements

D. M. Finch

R. B. Marxheimer

PAVEMENT brightness is an important factor influencing a driver's ability to see at night, because he is normally looking at the roadway with the result that the roadway surface looms large in the illuminated portion of his field of view.

Among the three methods available for making pavement brightness measurements — visual, photographic, and direct photometric — we have developed and used the last one. Attention has been given particularly to the determination of surface reflectance characteristics at low angles of incidence and low angles of viewing. Measurements have been taken in the vertical range from 0° to 8° above the horizontal, throughout horizontal ranges from 5° left to 5° right of the center axis, ranges comparable to headlight illumination and driver viewing.

A G-E spotlight, No. 4515, mounted in a housing with a shielding tube was used as a light source. A low level photometer was used as a receiver. Suitable mountings permitted precise variation of the vertical and horizontal angles of both source and receiver throughout the ranges studied. This equipment was designed and developed at the Institute of Transportation and Traffic Engineering, University of California, Berkeley.

Measurements were taken on three pavement samples removed from California highways: plant-mixed asphalt surfacing, asphaltic concrete and P.C. concrete. Each was examined under dry, damp and wet conditions, and readings taken at various angles.

Results of measurements were expressed in terms of "brightness factors," these being the multiplying factors relating the horizontal illumination to the brightness. For each sample and condition, iso-brightness factor curves were drawn for the angular ranges under consideration. These curves together with a second series, showing variations of the brightness factor with the various angular relationships, permit interpolation and prediction of brightness factor values for numerous conditions.

The data show large variations in brightness fac-

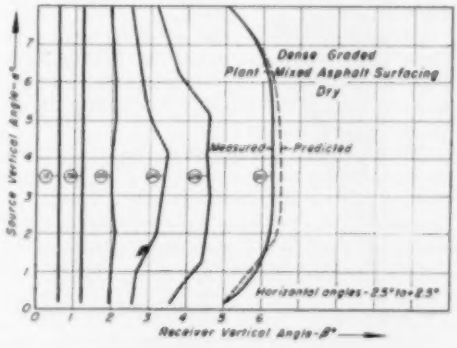

Figure 1. Iso-brightness factor curves.

AUTHORS: Associate Engineer, Institute of Transportation and Traffic Engineering, University of California, Berkeley, Calif.; and Kaiser Engineers, Div. of Henry J. Kaiser Co., Oakland, Calif.

tors with changes in vertical angles and minor variations with changes in horizontal angles of source and receiver, the receiver vertical angle being the most important factor in causing variations. For the angular ranges studied the P.C. concrete sample in the dry condition shows by far the highest brightness factors, as expected. The asphaltic concrete sample, however, presents higher brightness factors in the wet condition than does the wet concrete, and it exceeds noticeably the plant mixed surfacing sample when wet.

These preliminary data appear to warrant further study on actual highway surfaces in place. A portable light-proof tunnel has been constructed for this purpose and such field studies are being planned.

(Abstract of I.E.S. 1952 Conference Paper No. 17)

Report on Proposed American Standard Practice for Street and Highway Lighting

Charles H. Rex

THE Proposed American Standard Practice for Street and Highway Lighting is an essential aid to the development of motor vehicle transportation. Night use of our tremendous investment in streets and highways, autos, trucks, and buses depends upon light for good seeing. Properly-engineered roadway lighting provides comfort, convenience, safety, and economy for millions of people.

Some 20,000 copies of the 1947 "American Standard Practice for Street and Highway Lighting" have been distributed in the United States, Canada and abroad.

Its background involves a series of reports, extending back to 1928, which have been prepared by the I.E.S. Committee on Street and Highway Lighting.

City and State officials, as well as engineers, have found the "Standard Practice" to be a valuable basis for progress in the authorization, planning and appraisal of lighting that warrants public approval and enthusiasm.

The Illuminating Engineering Society and the American Standards Association now present a revision of this Standard Practice.* Five years' experience has indicated that clarifications and additional material will enhance its value.

Objectives and benefits of roadway lighting are now briefly discussed, along with fundamentals of seeing. Seeing includes visual comfort and the alertness of the motorist or pedestrian as well as visibility.

Proper distribution of light from luminaires is essential for efficient roadway lighting. Consequently, the additional information is presented pertaining to luminaire performance. Perspective diagrams are used to illustrate example light distributions on roadway surfaces.

Nine supplementary light distribution diagrams, such as Fig. 1 (Fig. 7 of the paper) are provided in the paper for the I.E.S. Annual Technical Conference.

The revised "Standard Practice" significantly clarifies the classification and measurement of vertical and lateral light distributions. The more complete isocandle diagram method of showing light distributions is explained in the Appendix. Roadway coverage diagrams are provided for estimating the transverse and longitudinal roadway distances covered by a light distribution. Iso-footcandle diagrams are illustrated showing the illumination on a roadway surface produced by a luminaire light distribution.

Recommended mounting heights have been revised to include 20,000- and 25,000-lumen lamps. In some instances a range of 25- to 30-foot mounting height is permissible.

Roadway illumination recommended for the Institute of Traffic Engineers' classification of night vehicular traffic and the I.E.S. classification of night pedestrian traffic is now presented in a single Table IV. Higher illumination levels are not discouraged.

*See p. 447 August 1952 issue of ILLUMINATING ENGINEERING.

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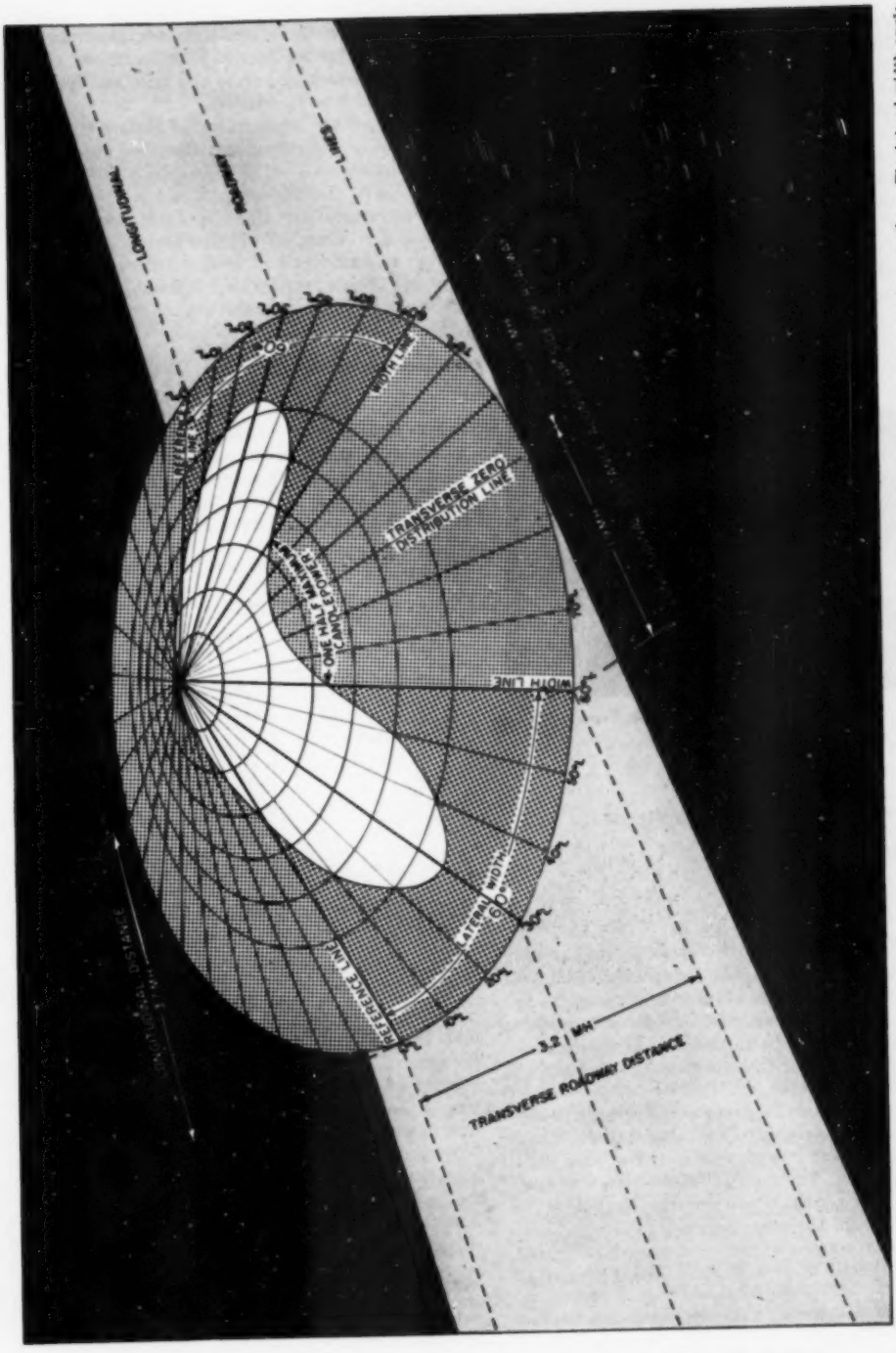

Figure 1. Type IV preferred lateral width of light distribution shown in an example cone of maximum candlepower based upon a roadway surface. The lateral width angle is measured from the Reference Line.

The statement on light depreciation now more specifically emphasizes that it is good practice to design a lighting installation with maintenance factors so that the average illumination in service will not fall below the current recommended average horizontal footcandles shown in Table IV. Luminaire and lamp maintenance factors are explained and used in formulas for computing average illumination, size of lamp, luminaire spacing, and lowest footcandle values at any point on the roadway.

Typical streetlighting layouts are shown in a new condensed Table V.

Special recommendations with new illustrations are provided for the lighting of intersections, railroad grade crossings, curves and hills, and special situations such as forestation.

Devices for the measurement of factors in roadway lighting are shown and described in a new Appendix section.

The I.E.S. Committee on Street and Highway Lighting are confident that use of this new "American Standard Practice" will significantly contribute to the more efficient and more extensive night use of motor vehicles, streets, and highways.

(Abstract of I.E.S. 1952 Conference Paper No. 20)

T. Knowles

D. A. Toenjes

Techniques for Photography of Lighted Streets

REALISTIC-APPEARING street lighting photographs require methods selected to handle low values and wide ranges of scene brightness. To be useful, general methods must be reduced to specific techniques that can be applied readily by a professional photographer without specialized knowledge of street lighting.

Our purpose in this paper is to outline a procedure that has given us photographs that are reproducible, realistic in appearance, and not too difficult to obtain. The theories involved are not new, but are here combined in a workable method.

How should the photographer choose his equipment and materials for photographing lighted streets? Which of his techniques should he vary as he goes from one scene to another, and which should remain the same? What measurements must he make at each scene? The answers to these questions are discussed separately and in detail in the paper, but here let us set them down in outline form.

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TABLE I.—Summary of Techniques.

Component	Adjustment for Scene		Description
	constant	variable	
Camera			
construction	x		view type with adjustable swings and rising and falling front
lens coating	x		coated lens desirable
lens focal length	x		preferably greater than the diagonal of the image size
aperture		x	selected according to scene requirements
Film			
characteristics	x		Super XX
exposure time		x	determined by brightness measurement and calculator (Fig. 1)
processing	x		14 min. in D-76 with intermittent agitation
Paper			
characteristics	x		Varigam projection paper
exposure time	x		determined by footcandles on paper in printing (negative removed)
processing	x		2 min. in Dektol 1:2

The determination of exposure time depends upon both the film sensitivity and the brightness of the scene. In order to reduce the variables, we have selected a single film and have related the exposure time to the measured scene brightness and the aperture in a simple alignment chart (Fig. 1).

The brightness measurement requires an optical brightness meter with telescope-type field, such as the Luckiesh-Taylor Brightness Meter. The procedure is as follows:

(a) From close to the camera position, select a portion of the scene corresponding to "threshold brightness," so dark that details and brightness differences in this "threshold area" are just barely discernible. Usually such an area can be found in the shadows along curbs,

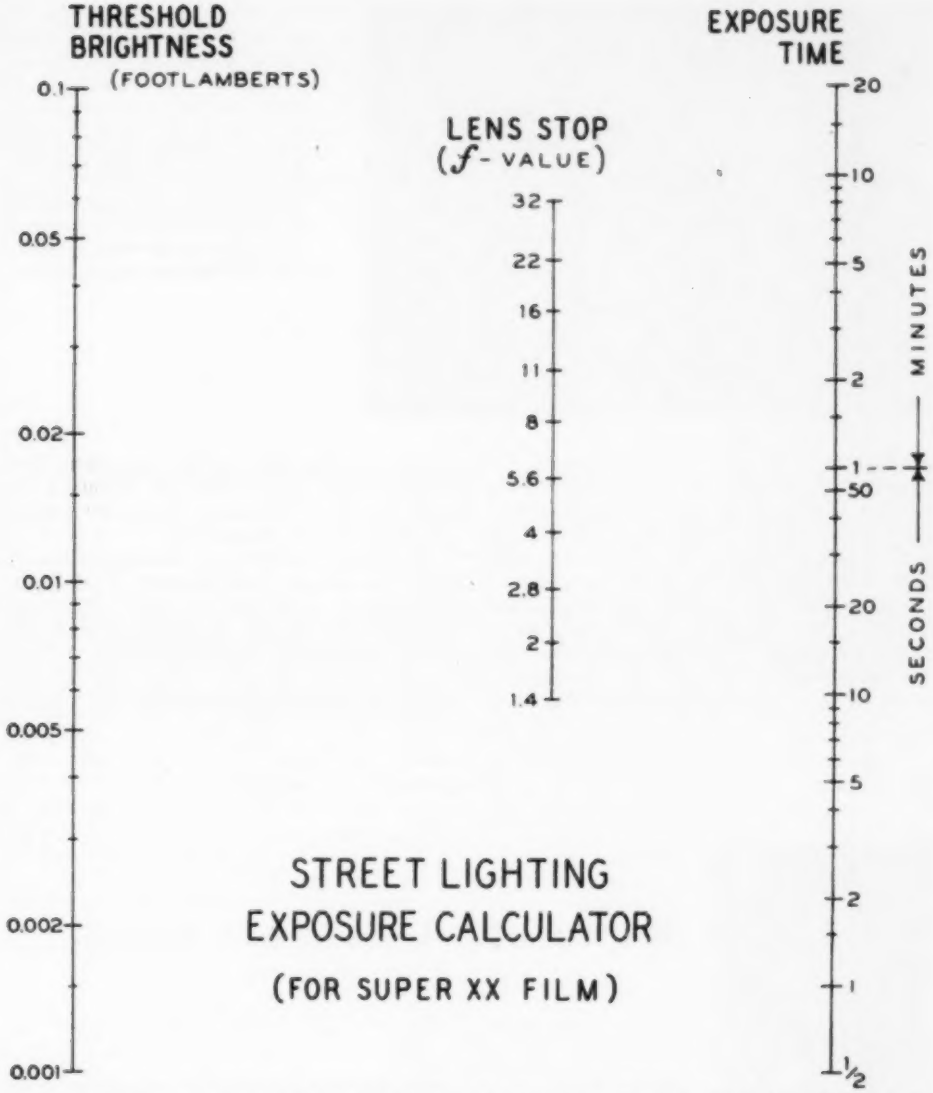


Figure 1. Exposure calculator. A straight line is laid across the three scales. Exposure time is determined from the measured threshold brightness and the lens stop.

behind parked cars, or between adjoining buildings that will appear in the photograph. In the case of very well-lighted streets or tunnels, it may be necessary to position some dark object in the field of view for this measurement.

(b) Measure the brightness of this threshold area. Indicate its brightness value in footlamberts and its exact position upon a sketch of the scene.

(c) Locate the brightness of the threshold area on the exposure calculator (Fig. 1), pass a straight line across the three scales, and read exposure time required for a selected aperture.

A dual-contrast printing yielded good gradation in the threshold areas, and at the same time helped to keep those areas acceptably dark in the resulting

Figure 2. Reproduction of residential street. Average horizontal illumination, 0.31 footcandles. Measured threshold brightness, beside curb ahead of parked car, 0.007 footlamberts. Exposure: 10 min. at f/11. Proper viewing distance for this reproduction: 10½ inches.

print. Two filters were used in succession, on "Varigam" high-speed projection paper. The first printing, 20 sec. through a low-contrast filter (#1), gives overall detail including the highlights. The added printing, 5 seconds through a high-contrast filter (#10), darkens the shadow areas and still retains their detail and separation, without materially darkening the bright tones. With the negative removed, the filament lamp's illumination upon the printing surface was 2.2 footcandles; at other footcandle levels, one should adjust his printing times accordingly. Experiments with other single filters between the #1 and #10 extremes of contrast, and with other papers, seemed to fall short of the results obtained with this combination.

Print viewing conditions — viewing distance and room illumination — are discussed in the paper. Additional topics included are lantern slides, halftone reproductions and motion pictures of lighted streets taken from a moving automobile.

(Abstract of I.E.S. 1952 Conference Paper No. 18)

Some Photographic Methods Applied to Photometry

Charles Marsh

THE collecting of photometric data by photographic means offers several advantages over other methods. Among these are speed, a large, effectively infinite, number of points, and, in some cases, automatic plotting of results. There are also disadvantages which have restricted its use. This paper describes some efforts to minimize the latter. Only those problems have been attempted in which the data required are in the form of variations of brightness. Of course, illumination may be determined from this brightness if the reflection or transmission factor is constant.

A series of photographic negatives is made, with exposures increasing in a series, such as 1, 2, 4, — *n*. These are processed to produce images in black and white only, rather than in the usual scale of greys. This method eliminates the problem of controlling all of the variables of photographic processing and

AUTHOR: Electrical Engineering Department, Pennsylvania State College. Consultant to Westinghouse Electric Corporation.

the need to read densities to interpret results. As many as twelve negatives can be printed on one paper. Greys are present in the picture, but their actual densities are unimportant, as it is their boundaries which are the contours of equal luminosity. It is necessary only that one can distinguish one shade from another.

For small ratios of exposure using equal time but different lens aperture, the brightness may safely be assumed to be proportional to the squares of the *f:* numbers. From one measured point the others may be extrapolated. Where the range is too great for this, several direct measurements may be made and interpolation used to obtain the contour values.

The method has been applied to determining brightness values of large, lighted fields, to interiors of buildings, and to objects as small as flashlight filaments.

The range of brightnesses is not limited by the latitude of the film, but only by halation effects.

A variation of this method reduces the work necessary in applying the point by point method.

(Abstract of I.E.S. 1952 Conference Paper No. 19)

The Kinorama as an Evaluator in Aviation Lighting

F. C. Breckenridge

A CLOSE relationship exists between illuminating engineering and psychology because it is only through the use of the eyes and mind that we utilize the results of lighting. The apparent motion of lights seen from moving vehicles, ships, and aircraft, makes this relationship of special significance in the field of transportation lighting and particularly in the use of visual aids in landing aircraft. In recognition of this the kinorama has been developed to introduce the kinetic element into the evaluation of lighting configurations. The history of this development is traced briefly in the paper and the mechanical and electrical systems of the laboratory and prototype models are described. There is also an outline of the procedure used in evaluating equipment and analyzing the results.

AUTHOR: National Bureau of Standards, Department of Commerce.
Project sponsored by Bureau of Aeronautics, Department of Navy.

The laboratory model has been used for comparing the three over-run lighting systems developed at Wright-Patterson Air Base with results consistent with those obtained at the Landing Aids Experiment Station in Arcata, California. A test of the relative guidance provided by the left-row, center-row, and slope-line systems was made but the results were not sufficiently clear and consistent to warrant releasing them in view of the controversial state of opinions on this subject. At the time of writing this paper a study of runway markings was in progress.

(Abstract of I.E.S. 1952 Conference Paper No. 21)

1952 Proceedings

A limited number of bound volumes, containing the published papers presented at the I.E.S. 1952 National Technical Conference, will be available. This paper-bound volume contains, in full, all the papers presented in this issue in Abstract. It will be available at a price of $2.00 from the Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

From the Session on

Applications

Tests Aimed at Realistic Maintenance Factors

R. L. Oetting

J. W. Tuttle

THE lighting depreciation measured in thirteen offices with a variety of lighting equipment is reported in this paper. The offices are located in the Engineering Building of the General Electric Company at Nela Park, Cleveland. The lighting systems are representative of most fluorescent equipment in schools and offices, and are similar to many in stores and better-quality industrial installations.

The offices chosen for test were under typical maintenance programs: rooms were washed or painted as appearance dictated; lamps were spot replaced as necessary; and fixtures were serviced twice a year by a window-cleaning contractor. The lighting equipment had been installed over a period of years, some rather recently. Illumination measurements were made of the offices (1) as found and (2) after fixtures were washed and relamped. In some instances, room surfaces were refinished as well. Illumination increased from 4.2 per cent to 61.3 per cent.[1] The spread indicates the difficulty of establishing realistic maintenance factors upon the results of such casual surveys.

Fig. 1 (Fig. 4 in Conference paper) shows the depreciation trend for each office compared with the average for all. Illumination surveys were made at regular intervals under stabilized conditions of voltage and temperature. A cosine- and color-corrected precision light meter was employed. Surveys were made each month in accordance with the I.E.S. method and, at more extended intervals, with stations on three-foot centers throughout each office.

Tentative separations between lamp and dirt losses are also made. Lamps were photometered for relative output initially and at least once again during the test period reported. Later, additional tests will separate the factors due to dirt on the lamps, the fixtures and the room surfaces. They involve washing procedures which will not be undertaken until the trends shown in Fig. 1 are established for a longer period of time.

A series of "atmospheric indicators" consisting of four-inch squares of various metal, plastic and glass, variously oriented, were installed in each office. Measurements of transmittance and reflectance were made to determine if a correlation exists

TABLE I.—Indicators Depreciating Within 2½% of Average Illumination During First 60 Days.

Office		1	2	3	5	6	7	8	9	10	11	12	13	Totals	
SAMPLES														Correlation with Average Depreciation Curve	Correlation with Room Depreciation Curve
Type	Pos.	Transmittance												Transmittance	
DP	Horiz.	—	x	—	x	x	—	x	x	x	—	—	—	6	5
	45°	—	o	—	x	x	—	o	x	x	—	—	—	4	5
	Vert.	—	—	—	—	—	—	—	o	—	—	—	—	0	1
SP	Horiz.	—	x	—	x	x	—	x	x	o	x	—	—	6	7
	45°	—	o	—	x	x	—	x	x	x	—	—	—	5	5
	Vert.	—	—	—	—	—	—	—	—	—	x	—		1	0
ALB	Horiz.	—	x	—	x	o	—	o	x	x	x	—	o	5	5
	45°	—	—	—	x	x	—	o	x	x	x	—	—	5	7
	Vert.	—	—	—	—	—	—	—	—	—	—	—	—	0	0

DP—Diffuse plastic (R.F. 41%, T.F. 56%). SP—Sandblasted clear plastic (R.F. 20%, T.F. 67%). ALB—Diffuse Alba-lite (R.F. 38%, T.F. 56%).
x—Correlates with average depreciation curve.
o—Correlates with room depreciation curve.

AUTHORS: General Electric Co., Application Engineering Division, Cleveland, Ohio.

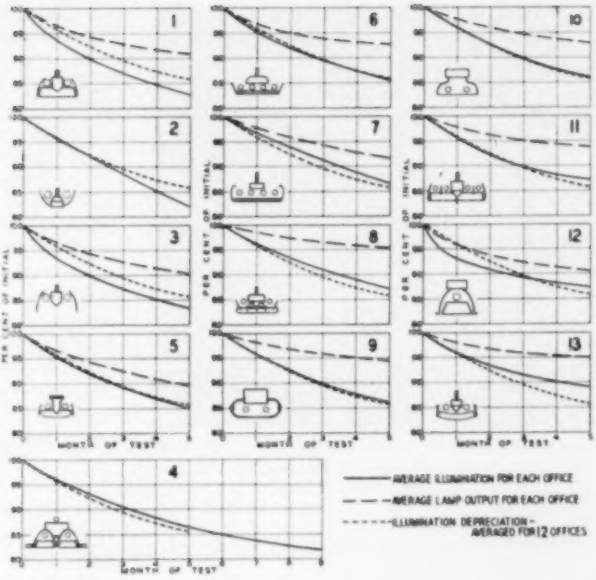


Figure 1. Lamp photometry and, hence, the separation of lamp and dirt depreciation effects is not possible for office 2 without disturbing the dirt on the semi-indirect units. The absence of office 4 from several of the tables is discussed in the footnote of Table I. Office 12 showed an unusually great depreciation during the first month suggesting insufficient seasoning of the lamps. Low-brightness, 40-watt T-17 lamps were also used in office 3 which showed a similar but less marked first-month effect.

between the depreciation of these factors and the depreciation of a respective lighting system. Samples showing a depreciation within ± 2.5 per cent of the average illumination depreciation at the end of both the first and second months are listed in Table I (Table V in Conference paper). Correlations with the illumination depreciation in individual offices are also tabulated.

The depreciation trends established are typical for the systems studied but additional surveys are needed to encompass the types of equipment employed and the variations in atmospheric conditions encountered. Such studies are needed to establish realistic maintenance factors approximating the accuracy of other data used in illumination calculations.

(Abstract of I.E.S. 1952 Conference Paper No. 26)

Time Versus Luminous Ceilings

Domina Eberle Spencer

Leonard F. Martin

AUTHORS: Dr. Spencer, Associate Professor at the University of Connecticut, Storrs, Conn.; Mr. Martin, President of Martin Electric Products, Inc., Somerville, Mass.

LUMINOUS ceilings are today in a situation somewhat comparable to that of fluorescent lighting in 1938. We had a marvelous new light source. But many of you will remember that even the small amount of design data available was in many cases completely ignored. Consequently, the errors resulting from inadequate engineering design were blamed on the fluorescent lamp. To obtain wide acceptance of the new light source, it was necessary

Figure 1. Fitchburg Youth Library, Fitchburg, Mass. First commercial combination of acoustic fins and luminous ceilings.

for us to learn new methods of design and to apply them widely.

Today the basic components of luminous ceilings are available: the lamps and the diffusing plastic. But many lighting engineers have not had sufficient experience with the design of luminous ceilings and do not realize the importance of applying the available engineering data. Successful luminous ceilings require the same careful design as was necessary for fluorescent fixtures. Again new methods of design must be learned and applied.

Four years of experience in the design and installation of luminous ceilings has shown that high coefficients of utilization, high maintenance factors, ideal visual conditions, and low cost are attainable in practice. Design methods have been thoroughly tested. Experience also has taught that many mistakes are often made in the design of the space above the plastic, the lamp spacing, the choice of plastic, the design and construction of the hanging system, the combination with acoustic, air-conditioning, and sprinkler systems, and the design of the luminous environment beneath the luminous ceiling.

The paper gives a simplified summary of the criteria which should be followed in the design of luminous ceilings, together with a discussion of many practical problems that have been encountered in the last four years. It is hoped that this paper will point out to the architect, the electrical engineer, and the illuminating engineer the need for a thorough engineering design of luminous ceilings. From the lessons time has taught, he may learn to make outstanding installations of luminous ceilings which will be free of many of the faults encountered in the past. Once the basic principles are mastered the architect will be free to design a wide variety of aesthetically attractive luminous ceilings.

(Abstract of I.E.S. 1952 Conference Paper No. 27)

Developments in Submarine and Small Vessel Lighting

LCDR Dean Farnsworth

IT BECAME increasingly apparent during the war years that the application of standard lighting methods to small vessels was producing unsatisfactory results. There was evidence of visual fatigue and decreased acuity in submarine personnel. Lighting standards were low and the congestion caused by increasing amounts of electronic gear and other new instruments resulted in even lower illumination levels, extreme contrasts and severe glare. Also, men were required to use their eyes more continuously owing to the increased use of new instruments such as radar and sonar and they had less chance to rest them in daylight and fresh air and with long-distance viewing owing to the advent of the snorkel which required continuous living undersea.

Analysis of the problems peculiar to small vessel lighting showed that the following requirements for

AUTHOR: U. S. Naval Medical Research Laboratory, New London, Conn.

The opinions or conclusions expressed in the paper are those of the author. They are not to be construed as necessarily reflecting the views or endorsement of the Navy Department.

fixtures were of particular importance: small size, directional distribution, high shock resistance, high efficiency and adaptability to red lighting. There were such special design problems as the uniform lighting of vertical dial panels six feet high, battery compartments with headroom of only three feet, dismountable fixtures for individual bunks, the narrow passageways, and shock-proof, vapor proof, portable emergency lights.

Many of the problems have been met by the "tuck-in" fixtures which use 8-watt, 12-inch fluorescent lamps. In particular, they permit recessed installation between pipes and in small spaces, highly directional light control with high efficiency, and are readily adapted to specialized applications. Numerous problems remain but illumination levels have been raised on the newest submarines to between 10 and 30 footcandles and brightness contrasts have generally been reduced to ratios of the order of 1 to 40.

A resumé is given of red lighting recommendations for dark adaptation aboard military vessels. In the coordination of lighting and compartment design, specific efforts have been made to obtain a sense of space, "changes of pace," moderately low background brightness, spectral coordination of the lighting with the paint and furnishings, uniform lighting of instrument panels by redesign of panels and dials, the elimination of glare and provision for eye rest areas.

Improvement in lighting has become one of the first considerations in the Navy's better habitability program.

(Abstract of I.E.S. 1952 Conference Paper No. 30)

Positioning of Directionally Adjustable Luminaires

Merle E. Keck

LUMINAIRES may be divided into two general classes, those which are designed to be mounted or installed in a fixed position relative to the plane to be lighted and those which are designed to be directionally adjusted after or during installation. Directionally adjustable luminaires in wide usage today include floodlights (used indoors or outdoors), many downlights, industrial concentrators, reflector lamps in adjustable mountings, and searchlights.

Installations which can and do use directionally adjustable luminaires are not limited to sports fields, parking lots, service stations and outdoor storage yards; but include gymnasiums, stores, churches, auditoriums and many others.

Inasmuch as the level of illumination and the uniformity of illumination will depend upon the directional adjustment of the luminaire, it is essential that the engineer planning such an installation specify not only the physical location of the unit but also its directional adjustment. The planning of such an installation requires a visualization of the illumination results from overlapping light patterns, which patterns themselves change in accordance with the angles and distances involved.

The approach used in this paper to the problem is one of presenting the photometric characteristics of the luminaire so that the changing light pattern can be easily determined for any directional angle.

Figure 1. Gymnasium lighted with directionally adjustable luminaires (floodlights in this case) utilizes the advantages of centralized luminaire location to reduce the cost of installing and maintaining the lighting equipment and electrical distribution system.

AUTHOR: Westinghouse Electric Corp., Cleveland, Ohio.

With the photometric data presented in this manner it then becomes possible to predict the results to be obtained by overlapping the light patterns using a definite system of overlapping described in this paper. The necessary photometric curves are shown for two typical luminaires, a sample problem is worked out and the results of a full scale check of the accuracy of the predictions are shown.

While it cannot be said that any system will make the prediction of results from directionally adjustable luminaires really simple, the author feels that a great deal of simplification can be achieved by the presentation of the photometric data in a form designed for the purpose. Certainly there are a great many problems in illumination ranging from the lighting of a baseball field to the lighting of a vaulted church dome which require that the light sources be directed at an angle to the surface to be lighted. The solution to such problems must be worked out on an engineering basis rather than on the basis of an educated guess.

(Abstract of I.E.S. 1952 Conference Paper No. 28)

Structural Lighting in a Modern Home

Aileen M. Page

THIS PAPER discusses the lighting of a modern house in which both general and local lighting are designed as a part of the house itself. Requests for this form of lighting are increasing, and it is therefore hoped that this discussion will benefit other designers. The ahead-of-construction planning and the techniques involved represent a pioneering coordination of living habits, architecture, materials, furnishings and lighting.

AUTHOR: General Electric Co., Application Engineering Division, Cleveland, Ohio.

In area this one-floor house encompasses 1900 square feet, exclusive of garage. Ceilings are white and all walls except in bathrooms are paneled in wood, with reflectances varying between 30 per cent and 45 per cent. The furniture is modern in design and all of it is either custom-built or built-in.

The lighting plan for the living room — used principally for entertaining — started with provision for local lighting. Recessed downlights — 13 of them — designed for projector or reflector lamps, provided a dramatic quality of lighting as well as high light output and controlled distribution. However, this limited-area high-brightness pattern while highly dramatic was not comfortable for times of

Figure 1. View through window illustrates the dramatic effects attained by coordinating architecture, interior design and structural lighting in a modern house. It also emphasizes the need for skilled help and advance planning in achieving these effects.

relaxation or for the visual uses of the room until supplemented by large-area lighted backgrounds to bring brightness ratios within comfortable limits. To create these visually-comfortable ratios in a mahogany-paneled room was the most challenging problem which faced the lighting designer.

As finally worked out, a total of 82 feet of in-built fluorescent lighting was used in this 20 ft x 33 ft room. Two-thirds of this footage was incorporated into a specially-designed combination cornice and cove placed over window areas to take advantage of the light-grey draperies and the ceiling to furnish large light-reflecting areas.

This problem and the others described in the paper will be present to a greater or lesser degree in any home where structural lighting is planned. Such specialized lighting requires skilled lighting design consultation as well as:

(1) Advance planning — *before beginning of construction.*

Most of the general and some of the local lighting has to be specifically designed to fit the space and conform to the architecture of the house. Consultation between architect, contractor, owner and lighting designer will indicate minor — sometimes major — changes in architectural design and construction detail.

(2) Coordination of interior finishes with the lighting design.

Particularly in rooms where critical seeing is done, the lighting designer must be allowed a voice in the decision on wall, ceiling and floor finishes — not necessarily the colors, but the values. Reflection of light from these surfaces is always of importance in the comfort and effectiveness of the lighting result, but it becomes *vital* in certain forms of built-in lighting.

(3) A flexible budget.

The specialized equipment, precision workmanship on custom-built luminaires and the careful supervision needed cannot be secured with a limited budget. It would be wiser not to attempt extensive structural lighting if these limitations are present.

(Abstract of I.E.S. 1952 Conference Paper No. 29)

For Discussion of I.E.S. Conference Papers

To submit discussion on any of the technical papers, presented at the I.E.S. 1952 National Technical Conference, for publication with the paper in ILLUMINATING ENGINEERING —

Send Three copies to the discussion organizer for the session (discussion organizers are listed below)
One copy to R. M. Zabel, Co-Chairman, Papers Committee, at Westinghouse Electric Corp., Bloomfield, N. J.

One copy to author of paper

One copy (original) to Miss Ruby Redford, Editor, ILLUMINATING ENGINEERING, 1860 Broadway, New York 23, N. Y.

Discussion Organizers

General — Afternoon, Sept. 8 — Papers 1, 2, 3, 4—Lt. Cmdr. Dean Farnsworth, U. S. Naval Submarine Base, New London, Conn.

Sources and Circuits — Morning, Sept. 9 — Papers 5, 6, 7 — G. S. Evans, Westinghouse Electric Corp., 5757 Trumbull Ave., Detroit, Mich.

Daylighting — Morning, Sept. 9 — Papers 8, 9, 10, 11, 12 — W. C. Randall, Detroit Steel Products Co., 2250 East Grand Blvd., Detroit, Mich.

Sources and Circuits — Afternoon, Sept. 9 — Papers 13, 14, 15, 16 — Ellery H. Raddin, Champion Lamp Works, 600 Broad Street, Lynn, Mass.

Outdoor Lighting — Afternoon, Sept. 9 — Papers 17, 18, 19, 20, 21 — D. W. Rowten, Westinghouse Electric Corp., 1216 W. 58th Street, Cleveland, Ohio.

General — Morning, Sept. 10 — Papers 22, 23, 24, 25 — D. M. Finch, Electrical Engineering Div., University of California, Berkeley, Calif.

Applications — Morning, Sept. 11 — Papers 26, 27, 28, 29, 30. Ray P. Teele, National Bureau of Standards, Connecticut Ave., and Van Ness St., N. W., Washington, D. C.

Questions and Answers on light sources

The I.E.S. Committee on Light Sources, under the chairmanship of E. H. Raddin, has prepared this listing of answers to frequently-asked questions. Readers are invited by the Committee to submit similar questions of general interest on light sources, to be considered for publication from time to time. Questions may be sent in care of Society Headquarters.

Do higher pressures in mercury vapor lamps improve the quality of light?

Discharges in higher pressures of mercury vapor lamps result in relatively more energy radiated in the visible spectrum and less in the ultraviolet. The mercury lines broaden. Relatively more energy becomes concentrated in the continuous spectrum background. The color quality improves.

What is the life expectancy of a fluorescent starter?

The latest draft of the proposed A.S.A. specification for fluorescent starters calls for a life test for the simple starter of 6000 starting cycles followed by 8 hours of deactivated lamp operation. Starters of the cut-out types are required to withstand 8000 starting cycles as well as an endurance test of the cut-out mechanism.

What is meant by the efficiency of a light source?

The efficiency of a light source is defined as the light output (lumens) delivered by the lamp, divided by the watts input to the lamp, and is generally expressed in lumens per watt (LPW).

Where auxiliary equipment is required, the overall efficiency is decreased by the power loss in the equipment.

What is the possibility of increasing the efficiency of incandescent filament lamps?

Any big improvement is not probable unless a new filament material is discovered which is more suitable than tungsten. The efficiency could be improved by using krypton gas but for most lamps this is not economical.

The higher the filament temperature, the higher the efficiency and the shorter the life. To get satisfactory lamp life it is necessary to operate the filaments at temperatures well below the melting point.

The maximum theoretical efficiency of a straight tungsten wire in vacuum at its melting point (3655K) is in the neighborhood of 53 lumens per watt. The highest efficiency commercially practical is in the order of 30 lumens per watt. This is obtained in some lamps designed for special applications and they necessarily have short life. General service lamps are currently available at an efficiency of approximately 8 lumens per watt for the 10-watt lamps and increasing up to 22 lumens per watt for the 1500-watt lamps.

See pages 8-5, 8-6, 8-7, 8-12, 8-13 and Tables 8-3 and 8-7, *I.E.S. Lighting Handbook*, Second Edition.

What are the chances of further improvements in fluorescent lamp efficiencies?

Very good. For the past ten years, there has been a steady improvement in both the brightness and lumen maintenance of fluorescent lamps. In 1946 a T12 white lamp of infinite length would have had an efficiency of 70 LPW. Today a similar lamp would have an efficiency of about 80 LPW. There is no theoretical reason why this is the ultimate which can be obtained. Continuing improvements in phosphors and lamp processing will undoubtedly permit lamps to be made consistently at much higher levels than those currently available. Improvements in lumen maintenance are also being obtained so that maintained brightness levels are higher and should continue to improve. Fluorescent lamps are currently available at an efficiency of approximately 62 lumens per watt for the 40-watt white lamps. When the wattage consumed by the ballast is added to the wattage of the lamp, the overall efficiency is in the order of 50 lumens per watt.

See Tables 8-42, 8-43, 8-44 and 8-46, *I.E.S. Lighting Handbook*, Second Edition.

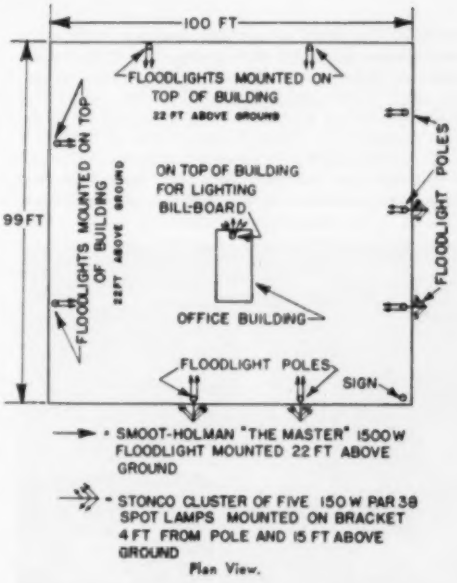
INSTALLATION AT SAN DIEGO CITY CHEVROLET USED CAR LOT, SAN DIEGO, CALIFORNIA.

Lighting a Used Car Lot

LIGHTING OBJECTIVE: To highlight automobiles to attract prospective customers and to facilitate adequate examination of the cars during evening sales hours.

GENERAL INFORMATION: This corner lot measures 99 x 100 feet.

LIGHTING INSTALLATION: Smoot-Holman 1500-watt floodlights arranged as shown in the plan view provide 25 footcandles general illumination. An additional 35 to 85 footcandles on the street side of the displayed cars is afforded by Stonco clusters of five PAR-38 spotlamps.


100 FT
99FT
FLOODLIGHTS MOUNTED ON TOP OF BUILDING
22 FT ABOVE GROUND
FLOODLIGHTS MOUNTED ON TOP OF BUILDING
22FT ABOVE GROUND
ON TOP OF BUILDING FOR LIGHTING BILL-BOARD
FLOODLIGHT POLES
OFFICE BUILDING
FLOODLIGHT POLES
SIGN
• SMOOT-HOLMAN "THE MASTER" 1500W FLOODLIGHT MOUNTED 22 FT ABOVE GROUND
• STONCO CLUSTER OF FIVE 150 W PAR 38 SPOT LAMPS MOUNTED ON BRACKET 4 FT FROM POLE AND 15 FT ABOVE GROUND

Plan View.

Lighting data submitted by W. A. Alden, Westinghouse Electric Corp., Los Angeles, California as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Series XVII 9-52

A.I.A. File No. 31

Architecture and Lighting of Office Buildings For Today and Tomorrow

By W. H. KAHLER

IT HAS been suggested that post-war office buildings are merely air conditioned and fluorescent lighted throw-backs to the 1920's. And a casual observation of recent new landmarks like the United Nations Secretariat with 5400 windows would indicate that today's architects have little faith in the survival of artificial lighting. With the feeling that neither is the case, my curiosity prompted a little scrutiny of office buildings constructed since the war.

We, as illuminating engineers, are interested in the architectural factors affecting the lighting system. To understand the architect's and owner's viewpoints, however, we should also be familiar with the fundamental economics of office buildings. If the structure is to be owner occupied, the cost should be in line with comparable rental space but other factors may allow some variance. The Lever House in New York, for example, has been designed partly to house and partly to advertise the giant soap maker. Therefore, a somewhat higher initial cost can be justified for Lever House than if the owners had merely developed the site with the single purpose of maximum profit. Offices for tenant occupancy are built primarily to realize a fair return on an investment which must be financially sound. With the inflated costs of construction one may first inquire if a new building can compete with existing space. The Field Building in Chicago costs 60c a cubic foot, for example, and today's cost would be $1.50 or more. We soon realize that new space cannot compete on a price basis. New buildings must rent for $5.00 or more per square foot against old buildings of $2.00 to $3.00. Therefore, new buildings must not only fulfill the fundamental requirements of a "roof overhead" but, to offset higher rentals, must offer extra items of appeal that are not available in older space.

AUTHOR: Westinghouse Electric Corp., Cleveland, Ohio.

Figure 1. The survey of new office buildings indicated a predominance of Troffer installations. The Farm Bureau Insurance Building in Columbus, Ohio, is typical of current office lighting practice. Troffers are for two 40-watt lamps, louvers are shielded 30 degrees normal by 25 degrees parallel to the lamps. Spacing of rows of Troffers is 9 feet, ceiling height is 10 feet and illumination in-service is 50 footcandles. Desks are light gray. Inset shows how Troffers are supported by the Troffer flange which snaps into the ceiling T-bars.

To obtain a representative picture of modern office buildings, the author studied more than 20 buildings constructed since the war. Table I is a tabular summary of architectural data important to the illuminating engineer.

Building Plan

In the past, plans providing maximum office space within 25 or 30 feet of the windows have been advantageous. Many architects now agree, however, that this advantage has been minimized by air conditioning and adequate artificial lighting. Such interior space in New York is now renting for $5.00 a square foot while a few years ago it was practically worthless.

The most useful plan will allow maximum flexibility of office arrangement which has led to the use of dimension modules. The module may establish the fenestration pattern, column spacing, and layout of air conditioning outlets and lighting. Modules of 4 to 10 feet have been used but it seems the 4- to 5-foot modules are preferred. The 4-foot fluorescent lamps can be readily adapted to these shorter modules.

Columns have always been a necessary evil because

they restrict office furniture arrangement, lighting layouts, and partition locations. Architects are using various means of minimizing columns. At the Prudential Building in Los Angeles, one-third of the columns were eliminated by going to a 25- x 30-foot spacing. The Tishman Building in New York conceals slender columns in the face of the building and thus eliminates projecting columns on the inside and outside of the wall. One architectural firm has devised a new framing method that is designed to make columns and pipe combinations more compact.

Space Planning

New tenants, required to pay $5.00 to $8.00 per square foot, have a counter-attack on high costs by planning the utilization of floor space more carefully. Office planning consultants are being retained by some tenants to make specific studies of departmental and individual office requirements. Also, new designs of office furniture such as the conference type desk make more efficient use of space.

Movable partitions are being used more, to meet the flexibility requirement. A variety of good looking types of partitions in both metal and wood and in a variety of finishes are now available.

Ceiling Heights

As illuminating engineers we always ask "What is the ceiling height?" Fundamentally the architect is concerned with the floor to floor dimension which determines the height of the building, over-all cost, and in certain cases compliance with building codes. In post-war buildings we have noticed a trend to lower ceiling heights, partially as a cost reduction factor but mainly because ceilings are furred down to conceal the air conditioning ducts. Our survey indicates floor to floor heights of about 12 feet and ceiling heights of 9 to 10 feet.

Fenestration

The great areas of glass used in modern architecture certainly indicate that daylight has been given high priority. The strip windows typifying new office buildings are largely influenced by a desire to express a certain style, to provide daylight illumination and to give a view.

We know as illuminating engineers, uncontrolled daylight may cause unbearable glare and architects also realize the inherent problems that accompany walls-of-glass construction. Even with double glazing which controls conducted heat, radiant heat and sun glare are fundamental problems that must be controlled by some form of shading. Internal shades like venetian blinds or draperies are frequently used as indicated by our survey, Table I.

A recent architectural trend is external shading in the form of horizontal or vertical louvers, fins, or projecting canopies. These devices in general are more adaptable to southern climates which have more high angle sun. Thus, in Los Angeles, the Prudential building uses horizontal louvers and the General Petroleum Building has vertical fins; and in Mobile the Waterman Steamship Building uses both horizontal and vertical shading. Under certain conditions, external sun shades are very practical but in many instances they are actually a very costly method of shading the top half of the windows.

Figure 2. As a direct opposite to Troffers, semi-direct lighting is gaining in acceptance for better quality of illumination. The nine-story Prudential Insurance Building in Los Angeles is lighted with two-lamp 40-watt semi-direct luminaires in continuous rows on 10-foot centers. Maintained illumination is 40 footcandles after four years' service. This lighting serves also an advertising purpose as the outside rows on each floor are operated until midnight, giving the building a luminous effect.

Environmental Control

Really, the extra items that count most in these new buildings are the environmental factors that influence the health, comfort, efficiency and attitude of the occupants and therefore justify the dollar difference in new buildings.

Every building in our study was found to be air conditioned and include acoustic ceilings. These are indications of the importance of controlled environment.

Decorating

Insipid tan walls and dark green desks have given way to an array of exhilarating color combinations and light furniture. There is more use of high chroma paints. Harmonious contrasting colors

TABLE I.—Architectural Characteristics of New Office Buildings.

	CITY— BUILDING— ARCHITECT—	No. of Floors	Floor to Floor Ht.	Ceiling Ht.	Column and Module Arrangement	Air Cond.	Natural Lighting Windows	Natural Lighting Shading	Artificial Lighting Type of Fl. Luminaire	Artificial Lighting Approx. Ft-c
1.	Baton Rouge Esso Building Lathrop Douglass	6	12'	10'	Col. 24' x 24' Flush in outer walls 4' Module	Yes	Clear Glass	3' Horizontal Shades and Ven. Blinds	Surface Mounted 2/40 W.	35
2.	Boston John Hancock Ins. Cram & Ferguson	26	13'	10'	Col. spacing varies No Module	Yes	Clear Double Glass	Draperies	Troffers 2/40 W.	45
3.	Boston New England Tel. & Tel. Co.	20	—	10'	Col. 20' x 20' No Module	Yes	Clear Glass	Pull-down Shades	Troffers 2/40 W.	40
4.	Columbus Farm Bureau Ins. Benham, Rickards and Armstrong	9	13'	10'	————	Yes	Clear Glass	Draperies	Troffers 2/40 W.	50
5.	Dallas Employers Ins. George Dahl	13	12'	9'	Col. 20' x 30' 10' Facade Module	Yes	Clear Glass	Draperies	Aluminum Troffers 2/40 W.	40
6.	Dallas Republic Nat'l Bank* Harrison and Abramovitz	34	—	9' 6"	Col. 22' x 26' 4' 5½" Facade Module	Yes	Clear Glass	Probably Venetian Blinds	Troffers 4' Slimline	Varies as to tenants' needs
7.	Dallas Rio Grande Nat'l Life G. Gill	16	12'	9'	Col. 16' x 18' Outer Col. flush in Wall 9' Facade Module	Yes	Clear Glass	Venetian Blinds	Direct-Indirect 4/40 W. Suspended 1'	35
8.	Des Moines State Auto Ins.	2	—	9'	Col. 24' x 24' No Module	Yes	Clear Glass	Draperies	Direct-Indirect 2 & 4 lamp Slimline 4', 6' & 8'	50
9.	Los Angeles Gen. Petroleum Wurdeman & Becket	11	11' 6"	9'	Col. 21' x 21' 7' Module	Yes	Clear Glass	Vertical Fins	Troffers 2/40 W. Prismatic Lens	40
10.	Los Angeles Prudential Wurdeman & Becket	9	13' 9"	10'	Col. 25' x 30' No Module	Yes	Clear Glass	Horizontal Sun Shades, Draperies	Semi-Indirect 2/40 W.	40
11.	Minneapolis N. Am. Life & Casualty Lang & Raugland	4	13'	10'	Col. 22' x 36' No Module	Yes	Clear Glass	Venetian Blinds	Troffers 2/40 W.	45
12.	New York 100 Park Avenue Kohn & Jacobs	36	11' 7"	11' on slab	Col. 21' x 21' No Module	Yes	Clear Glass	Venetian Blinds	Direct-Indirect 2/40 W.	35
13.	New York Lever House Skidmore, Owings & Merrill	24	12' 6"	9'	Col. 26' x 20' and 26' x 30' 4' 6" Modules	Yes	Clear Glass Heat absorbing	Venetian Blinds	Troffers 2/40 W. Prismatic Lens	50
14.	New York United Nations Secretariat	39	12'	9' 6"	28' Col. Spacing 4' Module	Yes	Clear Glass Heat absorbing	Venetian Blinds	Troffers 2/40 W.	30
15.	Pittsburgh U. S. Steel Harrison and Abramovitz	19	—	9' 6"	Col. 27' 6" x 33' 6" 6' 10½" Module	Yes	Clear Glass	Venetian Blinds	Shallow Surface 2/40 W.	35
16.	Pittsburgh Gateway Center Eggers & Higgins Irwin Clavan	24	11' 9"	9'	————	Yes	Clear Glass	Venetian Blinds	Troffers** Two-Lamp 4' & 6' Slimline	40
17.	Providence Providence Washington Ins. Co. Perry Craig & Shaw	6	—	10' and 11'	Col. spacing varies	Yes	Clear Glass	Venetian Blinds	Aluminum Troffer One T-8 Slimline	50
18.	San Francisco Pacific Gas & Electric Weiks, Frick & Kruse	13	12'	10'	————	Yes	Clear Glass	Venetian Blinds	Semi-Indirect 4/96" T-8	85
19.	San Francisco Standard Oil of Calif. Thompson & Wilson	22	13' 6"	10' 6"	————	Yes	Clear Glass	Venetian Blinds	Semi-Indirect 2/96" T-12 Slimline	35
20.	Tulsa 1st Nat'l Bank Carson & Lundin	20	12'	9' 5"	Col. spacing varies 5' Modules	Yes	Clear Glass Heat absorbing	Venetian Blinds	Shallow Surface 2/40 W.	40

*This building under construction.
**Lighting available on the basic lease agreement was to be 4/40 W. direct-indirect supplying 40 footcandles but most tenants are installing troffers or shallow surface units.

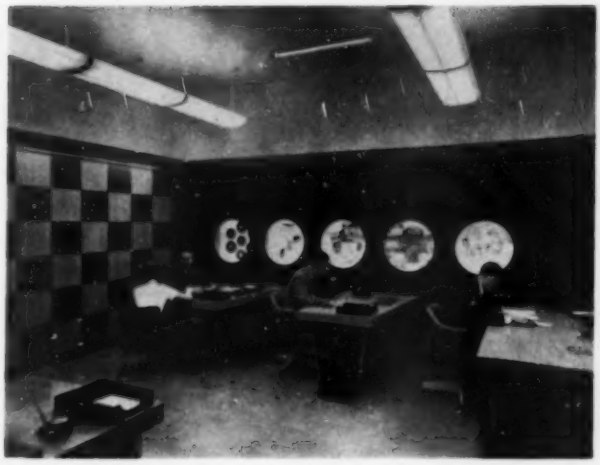


Figure 3. Planned environment is the key-note to the enthusiastic employee acceptance of these windowless offices in Chicago. Environmental factors employed to meet the human requirements include: (1) Quality lighting — illumination of about 75 footcandles is supplied with semi-indirect luminaires with four 96T12 slimline lamps each; (2) fluorescent sunlamps give employees, in an eight-hour day, an equivalent of 15 minutes in the summer sun; (3) interesting decorations and wall colors provide cheerful surroundings; (4) acoustic ceilings minimize the noise level from business machines and conversations; and (5) air conditioning includes germ killing bactericidal units in the air ducts.

give interest and variation to office areas that would otherwise be monotonous with a one-color scheme. Decorative wall papers in combination with painted walls are also used to give added interest and atmosphere.

Ceiling color is also claiming attention, particularly where direct recessed lighting is employed. The ceilings of Lever House in New York are beige acoustic tile. While we have generally recommended white ceilings for maximum reflection, there seems to be no reason why light colors with a reflection factor in the order of 60 per cent would not be satisfactory for direct lighting systems.

Office Furniture

For many years the Society has been recommending higher reflectance finishes for office furniture for more comfortable seeing conditions. Now light colored furnishings are available in several colors with reflection factors in the order of 35 per cent. The recently completed Lever House is equipped with all new furniture of a warm beige color for the linoleum desk tops and enameled metal desks and file cabinets.

Lighting in Today's Office Buildings

Lighting in most of our newest office buildings shows evidence of careful planning on the basis of:

1. Quantity of Light
2. Brightness Control
3. Architectural Fitness
4. Overall Economy of Operation

It is important to note that practically all layouts have been planned for 30 to 50 footcandles which is in accord with I.E.S. Recommended Practice of Office Lighting.

Of equal importance is the definite trend toward better quality lighting. Again I.E.S. recommendations are reflected in the limiting of luminaire brightness and the control of brightness ratios. Lighting methods have been as varied as architectural treatment and one cannot state that a certain method is best for all offices. The author has seen installations of troffers, direct-indirect luminaires, and semi-indirect equipment that are all acceptable from the standpoint of lighting quality and architectural fitness. The luminaires and louverall ceiling applications today are confined to private offices and special areas rather than general office buildings.

Direct Lighting

Low ceilings have led to a predominance of recessed troffers and direct shallow surface luminaires. But many of the previous shortcomings of direct lighting for offices have been minimized by better luminaire brightness control and by the use of light colored decorations and furnishings. Troffer brightness has been reduced by deeper louvers, aluminum reflectors or suitable lens panels.

Direct-Indirect Lighting

Ceiling heights of 9 to 10 feet, however, have by no means ruled out suspension luminaires. The problem with suspension equipment is to select the correct proportions of mounting height to ceiling height. Good appearance for suspended luminaires is not only dependent upon ceiling height but also upon room size. In large rooms higher mounting heights look better, while in small rooms lower mounting is architecturally acceptable. In a small office building in Des Moines, the ceiling is only 9

feet and direct-indirect luminaires are suspended on short stems. This job has a neat appearance and is producing acceptable lighting qualities.

Semi-Indirect Lighting

The trend for better quality has led to the use of semi-indirect fluorescent equipment in several large buildings. One good example is the Prudential Building in Los Angeles. This lighting problem was very carefully studied. Long before the building was constructed, Prudential engineers set up large areas of direct, semi-direct and semi-indirect lighting at their headquarters offices in Newark, New Jersey. A careful analysis was made of illumination quality, economics, and worker acceptance. The final choice was a semi-indirect fluorescent system selected primarily because it produced the best lighting quality. In particular, annoying reflected glare from glossy record cards was prevented. This system has been so successful that the Prudential engineers selected the same type of lighting for their Houston Building, now being completed.

For Office Buildings of Tomorrow

Planning for maximum worker efficiency has been important in recent years. Now the planning trend is toward environments for employee welfare and comfort, as well as for efficiency. Architect Owings expressed it well when he said "This environment should satisfy the animal comforts, for the eye, the ear, the body and we hope, the spirit."

I believe this planning for the human comforts is bringing architect, engineer and decorator closer together in their design ideas. More architects are now placing lighting as a foremost building component. Many lighting engineers are giving color and decoration a place in illumination design along with footcandles and footlamberts. Decorators and office layout specialists are gaining a greater appreciation of brightness control for creating a pleasant and comfortable environment. This cooperative thinking should bring to realization "planned visual environments."

Today we are in the 30- to 50-footcandle era but I feel that in 196X we will find 100 footcandles in demand for new office buildings.

However, 100 footcandle installations must be accompanied by greater comfort and lower cost per footcandle. We have found "fixtures" very practical for the 30- to 50-footcandle era but it takes just too many fixtures to obtain 100 footcandles. Therefore I feel that the 100-footcandle lighting will be done with large area luminaires in the form of luminous elements or completely luminous ceilings.

But, equipment designers will be called upon to give even greater attention to control of brightness to prevent discomfort glare. Also, we must find ways of simplifying maintenance on large area luminaires.

In the future several factors should reduce the cost per footcandle.

1. *Efficiency* — I believe we will have more efficient fluorescent lamps and better lumen maintenance. Lighting elements such as luminous ceilings may be more efficient than present day luminaires which necessitate a sacrifice in efficiency to obtain good brightness control.
2. *Maintenance* — Now that air conditioning is a part of modern office buildings, we can expect better maintained lighting efficiency because there will be less dirt in the atmosphere. Outside dirt will be excluded because windows will not be opened. Also we can expect improvement in air cleaning methods.
3. *Power Supply* — As lighting loads increase, there is more justification for using higher utilization voltages for lighting which reduce wiring cost. We can expect higher utilization voltages for lighting in the larger office buildings, a factor that will further the reduction in lighting cost per footcandle.

With higher illumination values practical, we can expect less emphasis on the need for large window areas. I feel that an out-of-door view will continue to be important for most office buildings but fenestration can be designed for view and sun control rather than for illumination. Sun shading and heat control can be simplified and can be more economical. The architects' problem will be to develop building features which have a pleasing style without great areas of clear glass.

Where the out-of-door view is unattractive, windows in the work areas may be completely omitted. This would reduce air conditioning 15 to 30 per cent. It would permit greater flexibility in office plans because window glare would no longer limit furniture placement. It has been found that interesting decorative treatments, comfortable lighting and air conditioning can create a working environment completely acceptable to office workers in buildings without windows.

Therefore, the architects' big problem of today and tomorrow is to coordinate planned environment with good appearance. This coordination must begin when the structure is conceived. All of the elements must be integrated as functional parts of the whole body of the building. Architect and engineer cooperation is an absolute "must" to develop designs to meet the human and economic requirements for office buildings.

INSTALLATION AT ELECTRIC SUPPLY CORPORATION, 701 WEST JACKSON BOULEVARD, CHICAGO.

Louverall Lighting for a Large Office

LIGHTING OBJECTIVE: To provide well distributed general illumination in an office area having an undesirable ceiling.

GENERAL INFORMATION: This 6000 square foot area was formerly a warehouse. The ceiling, 12½ feet above the floor, is covered with beams, pipes, air conditioning ducts and a sprinkler system. Surface characteristics are as follows:

desk tops	grey	30% RF
walls	peach	50% RF
dado	old rose	40% RF
columns		
top	blond	65% RF
bottom	walnut	30% RF
floor	old rose and peach	35% RF

INSTALLATION: Continuous rows of 30- and 40-watt 3500K white fluorescent lamps (Leader S-180 HPF with type A reflectors) are installed on 4-foot centers 30 inches above molded polystyrene (Leader) louvers $1\frac{1}{2}$" x $1\frac{5}{16}$" x 1" high which provide 40-degree shielding. The louvers are 9 feet above the floor.

(over)

A.I.A. File No. 31-J

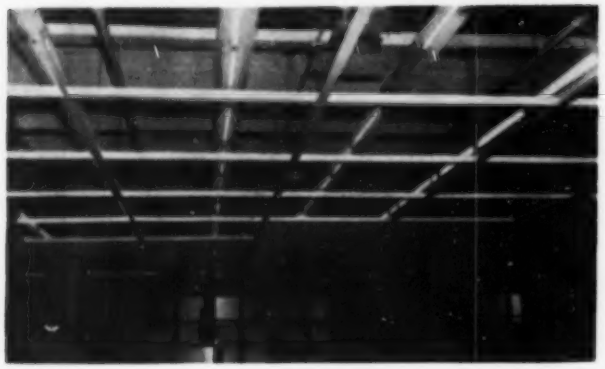


Figure 2. Installation detail.

Illumination after six months' operation was about 40 footcandles with the following brightnesses:

Louvers	
15° below horizontal	27.5 ft-L
30° below horizontal	43 ft-L
45° below horizontal	74 ft-L
Desk tops	14 ft-L
Wall	
near ceiling	41 ft-L
eye level	30 ft-L
Floor (average)	19 ft-L

Lighting data submitted by Gerald M. Marks, Electric Supply Corporation, Chicago as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Banana Classing—A Problem in Color

By DUNCAN PRESTON

WHEN Milady buys bananas at her favorite market, the chances are she only sees the yellow jacket and her judgment of quality ends with her appraisal of the color, size and shape. She could hardly be expected to know about the tender care and highly technical processing necessary before this Prima Donna graces her table or finds its way into junior's corn flakes.

The banana differs from most fruit in that it is a living thing after it is picked and the manner of control of its life, after picking, has a great bearing on the taste and texture. Let's follow it as it arrives on a rail siding at Badalament's Banana Company, in Detroit. The business at Badalament's has been handed down from father to sons. Many years of experience has been gained and great pride in their product has been instilled in every worker. No expense has been spared to insure proper handling and curing.

The fruit arrives by rail on a siding next to the building where sliding doors open for easy access to the cars. Telescoping canopies are provided over the doors so workers and fruit are not exposed to the weather during unloading. The stalks, which weigh 60 to 100 pounds, are hung on hooks attached to a novel conveyor system which operates much like a toonerville trolley. The fruit can be switched and routed to every point in the plant. The fruit is conveyed to a processing room where it is hung preparatory to curing. There are eleven such rooms at the plant, each of which is capable of holding four carloads of bananas. These curing rooms are equipped with highly complicated automatic controls which can refrigerate, heat, or create any degree of humidity up to a pouring rain. Carefully controlled ventilation is also provided to carry off just the right amount of gas which is generated by the fruit as it ripens. When the bananas are ripe, which usually requires three to four days, the stalks are hooked on the conveyor again and are sent to the grading and packing room. The hands of bananas are cut from the stalks and placed on one ent of a belt conveyor which has sponge rubber pads to protect the easily bruised fruit. They then travel past a group of inspectors and packers where they are selected and graded according to color and quality. Color of fruit selected is important in the grading operation. Several tests were made to determine the best illuminant to use in the lighting installation. Color of paint for the walls and ceiling was also very important. Shades of green, yellow, and black had to be correctly analyzed. It is at this point we must see the banana in its true light to enable the skilled graders to pack and grade the fruit accurately according to color.

Lighting recommendations for the grading area, which is 340 feet long, 21 feet wide, with no windows, included three rows of two 40-watt fluorescent luminaires on 7-foot centers, to provide 50 footcandles of illumination. For this installation, a luminaire providing a high upward component was recommended, which I felt would be necessary in such a long room to give the appearance of greater ceiling height, and create a more pleasing atmosphere. Good self-maintenance was also a factor.

The lamp recommended was the deluxe cool white, as tests showed the color perception under this lamp to be excellent. Incidentally, this was the first sizable installation of deluxe lamps in the Detroit area.

The walls were painted in Sun Tone down to a three-foot dado of medium dark green. The ceilings were painted white. The fixtures are mounted on trolley duct which was used for the wiring medium as it provided a maximum of flexibility.

Badalament, Inc. is truly a show place where efficiency and good appearance go hand in hand with good lighting. My thanks to Mr. Badalament for providing me an opportunity to work on a most interesting lighting job.

This installation was a runner-up in the contest for "My Most Interesting Lighting Job" conducted by Michigan Section of I.E.S.

AUTHOR: Detroit Edison Company.

TELECAST

LIGHTING NEWS OF CURRENT INTEREST

I.E.S. Gold Medal Nominations Due January 1

Nominations for the Society's highest award—the I.E.S. Gold Medal—are now being considered by the Medal Award Committee. Nominations for the award are invited from all members — closing date for their receipt is January 1.

The I.E.S. Gold Medal is awarded for the purpose of giving recognition to meritorious achievement which has conspicuously furthered the profession, art or knowledge of illuminating engineering. In making nominations for the Award, the following points should be observed.

(1) Candidates for the award need not be members of the Society, nor citizens of the United States or Canada, and may be nominated at any time by any member of the Society, by presenting to the General Secretary at Society Headquarters the name of the individual whose accomplishments in his field are deemed worthy of such recognition, whether it be in the field of engineering, design, applied illumination, optics, ophthalmology, lighting research, education, or administration and management.

(2) In order for a candidate to be considered for the award of a given year, a letter requesting consideration of the proposed candidate shall be delivered at the General Office of the Society before January 1 of that year.

(3) Nominations and records on file in the General Office from previous years, as reviewed and referred to the next year's committee by the previous Medal Award Committee, will be given consideration along with any new nominations.

The I.E.S. Gold Medal, established in 1944, accompanied by an appropriately engrossed certificate of award has been presented in past years to: George H. Stickney, Preston S. Millar, E. C. Crittenden, Matthew Luckiesh, Sir Clifford Paterson, Ward Harrison and William F. Little. Recipient of the award in 1952 is H. H. Magdsick.

See list of Sustaining Members, pages 25A, 26A, 41A, 42A

Flying Delegation Inaugurates So. Colorado and New Mexico Chapters

It seems safe to say that never until now have two I.E.S. Chapters, widely separated geographically, received their Charters on the same day, from the same group of presiding officials. Although 400 miles apart, and in two different states, Southern Colorado Chapter in Pueblo, and New Mexico Chapter in Albuquerque were officially established within a day's time, June 27, while the officers presenting the Charters were in their homes the same night.

First in the "double ceremony" was the Southern Colorado Chapter, the Society's 55th. Officers of the parent Rocky Mountain Section, G. B. Buck, II, J. R. Ray and F. Bischofberger formed a flying delegation leaving Denver early in the morning of June 27, for luncheon ceremonies in Pueblo. Early as it was, a number of Rocky Mountain members saw them off at the airport.

At Pueblo, they were met by Charles D. Bell, Chairman of the Southern Colorado Chapter, and several other chapter members. The Charter presentation, made by G. B. Buck, II to Mr. Bell, was held at a luncheon meeting at the Minnequa University Club, with 31 charter members attending. Included with the presentations was the gift of a gavel from the next "youngest" chapter, Central Illinois, Peoria. Speakers at the luncheon were Mr. Buck and Mr. Bischofberger who addressed the group on the newness and magnitude of the science of illumination, and the history and aims of I.E.S.

New Mexico

Following the Pueblo program, the Southern Colorado members accompanied the Denver delegation to the airport, where they took off for Albuquerque. Mr. Bell from Pueblo, joined them for this trip.

In Albuquerque the officers were greeted by a group of New Mexico Chapter members and taken for a tour of the city. The Charter program was held at a dinner meeting attended by 29 charter members of the New Mexico Chapter, and

(Continued on page 11A)

CHARTER members of the Southern Colorado Chapter inaugurated June 27 at luncheon meeting in Pueblo. C. D. Bell, the new Chapter's first Chairman holds the Charter.

FLYING delegation to Pueblo and Albuquerque to present I.E.S. Chapter charters. This group of Denver members were on hand at 7:30 in the morning to see the delegation off. Standing l. to r. on pavement: Harry Schockett, Stan Neumann, Ed Goldman, J. A. Setter, Harold Rankin, Al Swanson, Bill Lounsberry, Don Dyrenforth, Dean Carmichael, Jim Walton. Standing l. to r. on ramp: Jae Ray, G. B. "Jim" Buck, Joe Vivian, F. Bischofberger, Ruth Price, Stewardess, and Jack Painter, Pilot.

SOUTHERN Colorado Chapter receives Charter. L. to r.: J. R. Ray, C. D. Bell, Chairman, G. B. Buck, II and F. Bischofberger. The three Rocky Mountain officers flew to Pueblo to make the presentation.

ALBUQUERQUE group met J. R. Ray (right, on pavement), and on ramp, C. D. Bell, G. B. Buck, II, and F. Bischofberger, flying delegation officiating at New Mexico Chapter's Charter presentation.

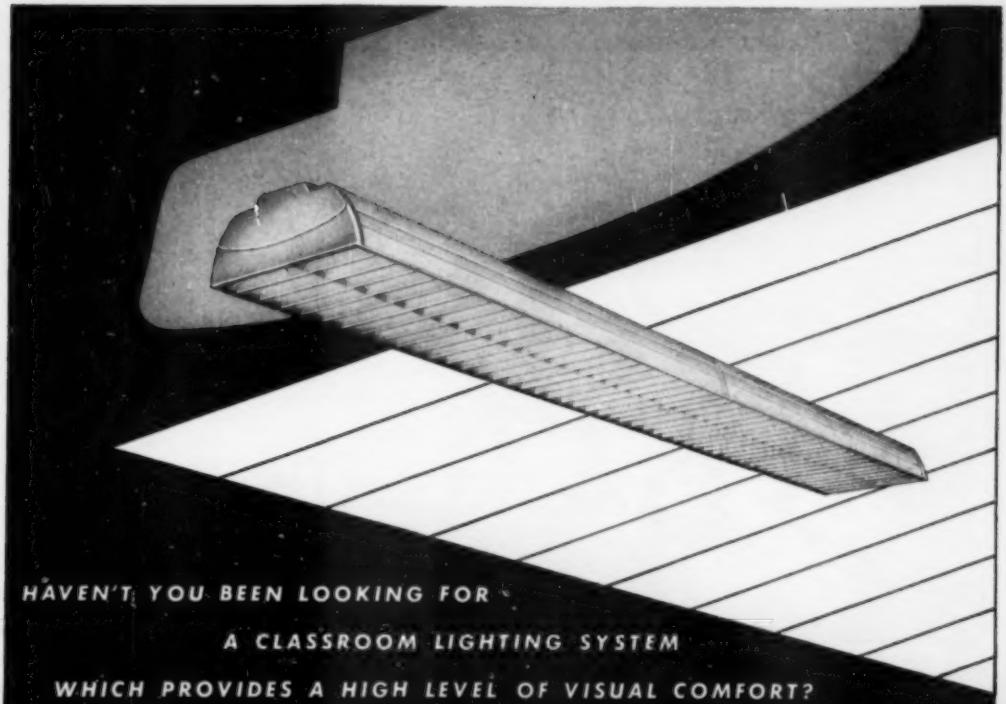
NEW MEXICO Chapter receives Charter, from delegation in Albuquerque. L. to r.: Gerald Joseph, Albuquerque; Charles D. Bell, Southern Colorado Chapter Chairman; G. B. Buck, II, Rocky Mountain Section Chairman; Fred Dunn, Chairman of New Mexico Chapter; F. Bischofberger, incoming Rocky Mountain Chairman; and S. Bozart, Jr., Albuquerque.

Turn the page for
Installations To See in St. Louis

Installations To See in the St. Louis Area

Class of Job	Installation	Address	Interesting Features
Women's Store	Garlands, Inc.	Clayton Area	Recessed incandescent together with atmosphere lighting.
Lounge and Conference Room	Tenth Floor, Union Electric Co.	Downtown St. Louis	Luminous plastic ceiling and recessed incandescent treatment.
Supermarket	Bettendorf's	Clayton Area	High level recessed incandescent with attractive cove lighting.
Men's Apparel	Wolffs, Clothiers	Downtown St. Louis	Different fluorescent and incandescent on each floor.
Railroad Freight Station	Missouri Pacific Railway Co.	123 Miller St. St. Louis	High level incandescent, glass covered RLM units. Terminal covers five acres.
Women's Store	Kline's West	Clayton Area	Unusual treatment in cove and downlighting in modern taste.
Gothic Church	St. Francis Xavier	Grand & Lindell Blvds., St. Louis	High wattage recessed downlights in a 75 foot ceiling.
School	Ladue Elementary School	Conway Rd. Ladue, Mo.	Classrooms lighted with opaque metal bowl luminaires.
Manufacturing Plant	Wagner Electric Corp., Brake Div.	Berkeley, Mo.	RLM fluorescent lighting on 480/277v, 3-phase, 4-wire system.
Bridge Lighting	Phillips Petroleum Corp.	Cahokia, Ill.	Bridge and barge dock lighting.
Foundry	Busch Sulzer Div., Norberg Mfg. Co.	3300 S. 2nd St. St. Louis	Combination mercury-incandescent high bay illumination.
Golf driving Range	F. C. Kruse	9750 Page Ave. St. Louis	56 enclosed floodlights providing good night visibility.
Florist	Brix, Florist	4820 Natural Bridge Rd., St. Louis	Complete treatment of store using incandescent and fluorescent.
Liquor Store	European Import Corp.	Clayton Area	Champagne taste in lighting.
Department Store	Scruggs-Vandervoort and Barney	Clayton Area	Interesting star-like illumination.
Hotel	Jefferson Hotel	Downtown St. Louis	Exciting shopping centers and entertainment areas.
Jewelry Store	Jaccards Store	Clayton Area	Show window techniques applied to interior store displays.
Department Store	Famous & Barr	Clayton Area	Interesting dramatic displays.
Manufacturing	Commercial Matrix Co.	1725 Olive St. St. Louis	Unusual treatment of shop and office areas.
Appliance Sales Room	Union Electric Co.	E. St. Louis, Ill.	Complete louverall ceiling of large area display floor.
Bank	United Bank & Trust Co.	B'way & Washington Ave., St. Louis	Incandescent and fluorescent, direct and indirect with cove lighting combined in this area.
Office	American Stove Co.	Kingshighway Blvd. St. Louis	Modern office building with entirely recessed incandescent and fluorescent throughout.
Church	St. Alphonsus (Rock Church)	Grand Ave. St. Louis	Entirely recessed high wattage downlights in gothic type church.
Auditorium and Office	University City Hall	University City Mo.	Incandescent and fluorescent dramatic lighting. Recessed spotlighting in 28-foot dome.
Schools	Ferguson Schools	Ferguson, Mo.	Plastic bowl luminaires in all classrooms in school district.
Office	Groves Laboratories	Clayton Area	Modern offices and plant which combine new fluorescent and incandescent techniques in every area.
Library	St. Louis County Library	6814 Natural Bridge Rd., St. Louis	Incandescent and fluorescent recessed luminaires.

Listing compiled by the St. Louis Section, I.E.S.



HAVEN'T YOU BEEN LOOKING FOR
A CLASSROOM LIGHTING SYSTEM
WHICH PROVIDES A HIGH LEVEL OF VISUAL COMFORT?

—BUT AT L.O.C.

Drawing on 108 years experience in manufacturing top quality lighting equipment, the Miller Company has developed, and proudly presents, the LEXINGTON.

SPECIFICALLY ENGINEERED — to meet your need for evenly-distributed, softly-diffused classroom lighting of high efficiency, and with extremely low brightness. Not only is first cost low, but so is its overall cost — the very important consideration — Low Overall Cost.

NOTE THESE FACTS ABOUT L.O.C.

INSTALLATION COST: LOW — simplified by sliding clamp hanger mounting.

MAINTENANCE COST: LOW — only one ladder position needed for relamping — only ETL Certified ballasts used.

LONG, USEFUL LIFE: assured by sturdy Miller QUALITY construction — rigid, T, cross-section channel — extremely strong louver assembly, with cross baffles and side rails of one-piece steel, interlocked with center baffle and end plates.

FINISH — 89% reflection factor. Hot sprayed high-bake white enamel over steel rust-protected by 5-stage Bonderite process.

IDEAL classroom lighting — at L.O.C.

WRITE FOR FULL DETAILS ABOUT MILLER LEXINGTON.

It is the newest addition to Miller's complete line of luminaires — Fluorescent, Incandescent, and Mercury—which cover a wide range of industrial and commercial lighting requirements.

Miller field engineers and distributors are conveniently located for nation-wide service.

THE miller COMPANY

Equity Savings & Loan Company, Cleveland, Ohio. The main office and three private offices are lighted by Wakefield Ceilings, incorporating PLEXIGLAS diffusers. Architects: Dalton-Dalton Associates, Cleveland. Installed by Parbar Electric Company, Cleveland. Wakefield Ceilings are produced by The F. W. Wakefield Brass Company, Vermilion, Ohio.

Lighting . . . Air Diffusion . . . Sound Control . . .

Combined in a Luminous Ceiling

The Wakefield Ceiling shown above, with its corrugated PLEXIGLAS diffusing panels, combines three functions in a single installation.

• Mounted wall to wall beneath fluorescent tubes, the acrylic plastic panels provide high level, low brightness, evenly diffused illumination.

• Conditioned air from the space above the luminous ceiling is delivered into the room through the openings at the edges of the corrugated diffusers. The multiple openings insure an even distribution of air, with elimination of drafts on customers and employees.

• The simple framework for the PLEXIGLAS also supports acoustical baffles which absorb sounds from the work area.

This Wakefield method of combining air diffusion and sound control with the *best* in lighting—using PLEXIGLAS acrylic plastic—can reduce building construction and operation costs. In addition there is the advantage of duct-free, fixture-free appearance.

We will be glad to send you details about the installation shown above, and tell you how PLEXIGLAS may solve *your* lighting problem.

Canadian Distributor: Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada.

PLEXIGLAS is a trademark, Reg. U. S. Pat. Off. and other principal countries in the Western Hemisphere.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

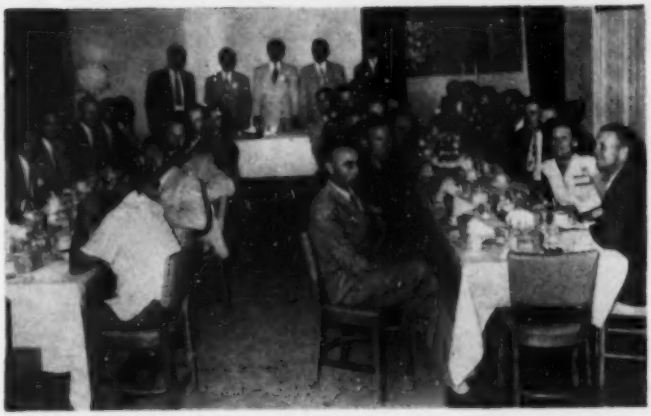
Representatives in principal foreign countries

(Continued from page 6A)

again Mr. Buck and Mr. Bischofberger were the speakers.

The Charter was accepted by Fred Dunn, Chairman of the New Mexico Chapter.

This group too, received a gavel from the next youngest chapter—youngest in this case by only a few hours. The gavel, a gift from Southern Colorado, was presented by that Chapter's Chairman, C. D. Bell. The gavel was constructed of cedar wood which came from the lintel above the door of the first jail in San Luis, Colorado, one of the state's earliest settlements. Said Mr. Bell in his presentation, "It seems probable that some of the Old West's famous bad men . . . spent many hours gazing at this piece of wood, which will now go on in the service of mankind by calling to order the meetings of a group dedicated to the relieving of man's burdens."



NEW MEXICO Chapter Charter members gather for Charter presentation in Albuquerque, June 27, 1952.

Tucson, Arizona Holds First I.E.S. Meeting

Before the new Arizona Chapter (chartered this year in Phoenix) had even completed its first year of operation, it was already sponsoring extension meetings elsewhere in the state — of such proportions as to suspicion the formation of still another I.E.S. Chapter.

A full-scale program was held Saturday, June 14, at the Catalina Guest Lodge, Tucson, under the auspices of the Arizona Chapter. In addition to Tucson members in attendance, a large turn-out from Phoenix and nearby points was organized by a temporary Transportation Chairman for the trip. The members met for a braised chicken dinner at the Tucson hotel, and an opportunity of closer acquaintance.

Highlight of the program was a talk on "Newton's Spectrum Experiment and Color Mixing," by Dr. Earle H. Warner, Professor of Physics and head of the Physics Department, University of Arizona, Tucson.

Committees Appointed for Southern Regional Conference

Regional Conferences are more and more assuming the stature of national conventions. The same goes for their planning apparently, since months prior to the opening session, committees are already at work for the Southern Regional Conference scheduled for May 18 and 19, 1953 at Sedgefield Inn, near Greensboro, North Carolina.

Co-Chairmen A. L. Ducker, Jr., and J. H. Walsh, Jr., have announced that the Conference Executive Committee will consist of the Regional V-P, R. Cecil Paslay, themselves as Co-Chairman, George E. Wilkinson as Secretary and D. Mack Woodside as Treasurer. Committees have been appointed as follows:

Papers and Programs — Roy A. Palmer and G. E. Park, Co-Chairmen
Registration — J. Wesley Lewis
Entertainment — Harry Phillips
Finance — D. Mack Woodside
Publicity — R. M. Johannesen
Decorations — E. T. Green
Transportation — Willis B. Harris

The potential attendance at regional conferences is considerable. The seven Sections and Chapters comprising the Southern Region, for example, have some 661 members. This includes Carolinas Chapter, Florida Chapter, Georgia Section, Mississippi Chapter, New Orleans Section, Southeast Florida Chapter and Tennessee Valley Section.

Lighting Fundamentals Course Starts This Month in N. Y.

Enrollments are now being accepted for the New York Section's Fundamentals of Illumination Course, scheduled September 29 through December 15, 1952. Sessions will be held weekly, on Monday evenings 6:30 to 8:00 at the conference room, 815, of the Consolidated Edison Co. of New York, 4 Irving Place, New York City. Tuition fee is $10.00 to I.E.S. members, $20.00 to all others.

An especially comprehensive program has been arranged, to be presented by

(Continued on page 14A)

Errata

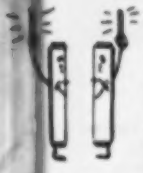
The proposed American Standard Practice for Street and Highway Lighting appearing in the August 1952 issue of ILLUMINATING ENGINEERING was developed by the 1950-51 Committee on Street and Highway Lighting and not the 1951-52 Committee as listed. The Committee involved is as follows:

R. M. Zabel, *Chairman*	R. D. Wyatt, *Vice-Chairman*	C. H. Rex, *Secretary*
J. W. A. Bollong	L. F. Heckman	H. W. Osborne
R. P. Brotzman	O. W. Holden	K. M. Reid
J. B. Browder	R. M. Hoot	D. W. Rowten
R. S. Bucher	H. F. Ilgner	L. J. Schrenk
F. M. Carter	G. W. Izant	T. J. Seburn
W. H. Edman	L. M. Johnson	W. A. Shaw
J. H. Fahey	E. B. Karns	R. E. Simpson
D. M. Finch	G. E. Korten	R. G. Slauer
G. K. Glass	Carl H. Lundell	R. M. Swetland
C. A. B. Halvorson	J. F. McGough	G. A. Trosper
G. K. Hardaere	R. S. Newhall	Stuart R. Williams
W. Earle Hawkins	J. J. Oberhausen	H. L. Wojcik
J. L. Hays	O. P. Ortlieb	J. W. Young

announcing...

THE *1st Lead-Lag Ballast for Rapid Start Lamps*

NEW JEFFERSON LEAD-LAG BALLASTS GIVE YOU THESE ADVANTAGES



Each Lamp Operates Independently!

Unlike series operation, flickering or complete failure of one lamp has no effect on the other. The good lamp receives full wattage—burns bright and steady. Even if the faulty lamp is not replaced for days, the Jefferson Ballast and remaining lamp will function normally. Lamp life is not affected or shortened in any way—regardless of whether it is on the lead or lag side of the ballast. Defective lamps are spotted instantly. Replacement is fast, with no time lost in checking for the source of trouble.

No Increase in Ballast Temperature When One Lamp Fails!

The new Jefferson Ballast continues to operate at the same low temperature should either lead or lag lamp fail. Elimination of increased ballast temperature, encountered with a lamp failure in preheat type circuits, assures maximum performance . . . and extra years of top notch ballast life and lighting economy. The outstanding advantages of the lead-lag ballast design, offers reduced maintenance, rated lamp life and brilliancy, and greater satisfaction for users of the new Rapid Start Lamps.

Small, Light Weight, Quiet, Powerful

Here's a Lead-Lag Ballast the same size as present series sequence types. All the features of series circuits are combined with the advantages of the lead-lag type. This one new Jefferson Ballast gives you rapid starting, power factor correction, and independent lamp operation. Low watt loss is inherent in its unique design. It is quiet operating, furnishes maximum lumens per watt, and provides positive starting even at voltages as low as 106 volts.

COMPARE THESE FEATURES		
FEATURES	JEFFERSON LEAD-LAG BALLASTS	SERIES SEQUENCE BALLASTS
Independent Lamp Circuits	YES	NO
Protects Good Lamp if one fails	YES	NO
Ballast Unaffected by a lamp failure	YES	NO
Stroboscopic Correction	YES	NO
Small Size—light weight	YES	YES
Eliminates Starters & Sockets	YES	YES

Stroboscopic Correction

The new Jefferson Lead-Lag Ballast circuit automatically minimizes stroboscopic effects. Out of phase current supplied to both lamps by the Jefferson Lead-Lag Ballast together with longer lag phosphor lamp coatings provide the ultimate in even fluorescent lighting. This feature is especially important when Rapid Start Lamps are used for industrial applications where rapidly rotating or moving machinery may cause "strobe" difficulties.

THE NEW JEFFERSON RAPID START BALLAST

CAT. NO. 254-601

•

WEIGHT APPROX. 6½ POUNDS

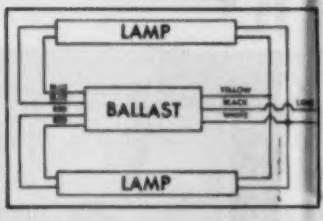
•

DIMENSIONS

2⅜" HIGH—3⅛" WIDE—CASE LENGTH 8¼"

MOUNTING 8⅞" x 2"

WIRING DIAGRAM



JEFFERSON ELECTRIC COMPANY

BELLWOOD • ILLINOIS

Deliveries Start September 1st

Jefferson

LEAD-LAG BALLAST

CAT. NO. 254-601

FOR TWO 40 WATT RAPID START LAMPS

(Continued from page 11A)

leading authorities on the various subjects. The 12 sessions will include:

September 29—Theory of Light and Control
October 6—Illumination Terms
October 13—Filament and Electric Discharge Lamps
October 20—Fluorescent Lamps and Auxiliaries
October 27—Equipment Design
November 3—Lighting Requirements
November 10—Illumination Computations
November 17—Computation and Maintenance
November 24—Industrial Lighting
December 1—Lighting for Selling
December 8—Light for School and Office
December 15—Economics of Lighting

Coordinators for the course will be L. R. Anderson of General Electric Co.; L. Goren, Globe Lighting Products; R. W. Wylie, Sylvania Electric Products, Inc.; and R. Zahour, Westinghouse Electric Corp.

Enrollment information may be obtained from C. Forster, Westinghouse Electric Corp., Bloomfield, N. J.

Advance Plans Made for Great Lakes Regional Conference

A preliminary meeting outlining plans for the 1953 Great Lakes Regional Conference, scheduled for Syracuse May 25 and 26, was a feature of the annual summer outing of the Central New York Section, the regional meeting's host next spring.

Regional Vice-President "Lew" Twitchell assisted in planning the long range activities necessary to a successful conference.

A total of 97 members and guests also enjoyed golf, boating and games at the outing held June 13 at the Skaneateles Country Club. A dinner attended by President-Elect E. M. Strong climaxed the program.

Officers elected to serve the Section for the coming year were introduced, and Dr. C. L. Cottrell, retiring Chairman, was presented with a Certificate of Appreciation suitably framed.

C.B.S.-TV Features Lighting Lectures by Luckiesh

A 30-minute lecture on light, vision and seeing, given by the country's leading exponent of that subject, Dr. Matthew Luckiesh, was a feature of the television program, "Summer School," July 30. In addition to his educational talk, Dr. Luckiesh gave interesting demonstrations ranging from early oil lamps to the firefly and modern fluorescents.

"Summer School" is a popular daytime program (3:30 p.m. E.D.S.T.) originating from WCAU-TV, Philadelphia. Through the facilities of the entire C.B.S. network, it is seen in all parts of the country.

Back Issues of I.E. Available

Anyone interested in purchasing complete sets of ILLUMINATING ENGINEERING and its predecessor, *Transactions of the Illuminating Engineering Society*, from 1930 to 1949, may write to Maxwell Lind, 248 East 34th Street, New York 16, N. Y.

Four Groups of Winners Announced For Membership Campaign

Results of the 1951-52 membership campaign have been tabulated and the winners announced, by R. G. Slauer, Chairman of the Membership Committee. This year, for the first time, a plan was used whereby Sections and Chapters competed only with others of comparable size. Winners in the four groups and the per cent net increase in membership are as follows:

GROUP I (over 200 members)
- First prize—Northern California Section — 10.9 per cent
- Second prize—Southern California Section — 7.8 per cent

GROUP II (100-199 members)
- First prize—Twin City Section — 18.7 per cent
- Second prize—Southwestern Section—13.7 per cent

GROUP III (50-100 members)
- First prize—Rocky Mountain Section —40.2 per cent
- Second prize—British Columbia Section —20.2 per cent
- Third prize—Rochester Section — 11.1 per cent

GROUP IV (under 50 members)
- First prize—Arizona Chapter—82.1 per cent
- Second prize—Oklahoma Chapter—41.5 per cent

The extra award is given in Group III since it contains the largest number of Sections and Chapters. The cash awards are:

First place — in each group — $30.00
Second place — in each group — $20.00
Third place — Group III only — $10.00

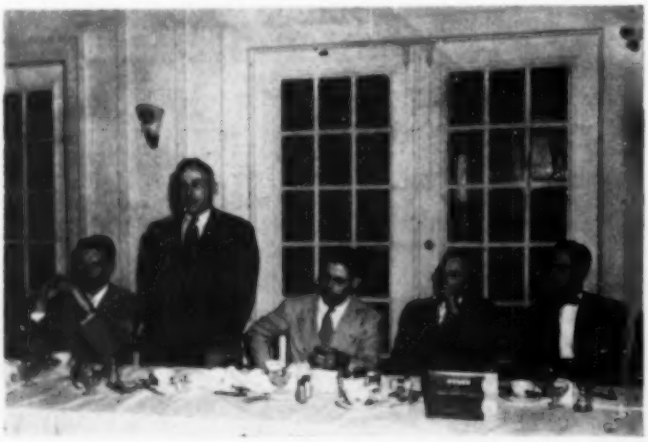
Illumination of Korea's No-Man's-Land

According to a release from the Army Home Town News Center, Kansas City, Mo., and a story mailed from Korea July 15, 1952, Pvt. Raymond Conklin of 26 Brooklyn Ave., Valley Stream, L. I., N. Y., is one of the men in Korea that the Communists would like most to eliminate.

He operates one of the 800-million candlepower searchlights that are used to illuminate no-man's-land and prevent the enemy from staging surprise night attacks.

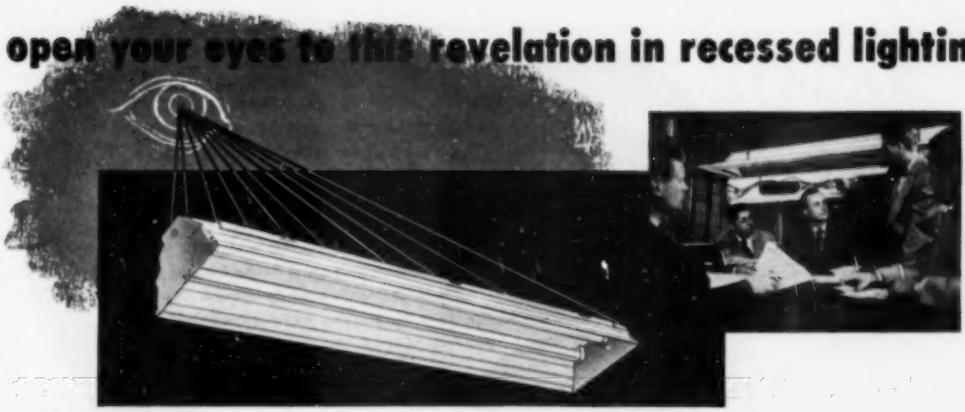
Within the past few weeks, two Communist patrols have attempted to penetrate American lines and destroy the searchlights but both times 7th Division infantrymen threw them back. Communist artillery has tried to knock out the

(Continued on page 17A)



CENTRAL New York Section's closing program featured a preliminary meeting on plans for the 1953 Great Lakes Regional Conference scheduled for Syracuse next May 25 and 26. Shown at dinner session are: B. H. Goodman, incoming Secretary; E. M. Strong, National I.E.S. Pres.-Elect; C. L. Peckham, retiring Secretary; C. L. Cottrell, retiring Chairman; W. L. Lawrence, incoming Chairman of Central New York Section.

open your eyes to this revelation in recessed lighting



MITCHELL *uni-flow* fluorescent troffers

NOW you can specify recessed lighting that's years ahead of anything in the field. It's MITCHELL UNI-FLOW . . . completely new . . . dramatically different . . . easier to specify, easier to install, far superior in lighting efficiency. Architects, contractors, utility men and wholesalers say unanimously: *"This is what we've wanted in recessed lighting!"*

JUST 4 EASY STEPS TO A PERFECT *uni-flow* ONE MAN INSTALLATION

1 Uni-Hangers are roughly located in ceiling opening (no critical measuring required). Takes just minutes, regardless of ceiling construction. Saves hours of time on any job—cuts installation costs sharply.

2 Troffer shell (less ballasts, lampholders or reflectors) clamps to Uni-Hangers by means of special Uni-Liner clips (an easy one-man job). Simple screwdriver adjustment levels troffer properly.

3 Reflector-ballast-lampholder plate (the bulk of the total troffer weight) is attached to troffer shell by means of jack chains. Thus, there is no weight on the installer's hands when wiring.

4 With wiring completed, reflector-ballast-lampholder assembly attaches to troffer shell by means of exclusive "Perma-Latch" (no tools or extra loose parts required). Job is now ready for easy lamping.

HERE'S EVERYTHING YOU NEED FOR SIMPLIFIED RECESSED LIGHTING

Here is a complete family of matching troffers in every useful length. Units are available in 2-foot, 4-foot, 5-foot, 6-foot, 8-foot or 10-foot lengths, in deep (10") or shallow (7") types.

Here is the widest selection of shielding equipment: choice of Metal Louver, Plastic Louver, Alba-Lite, Prismatic Glass, Unilens, Twinlens, Curved Lens, Fota-lite, Longitudinal Shields and Crosswise Baffles.

UNI-FLOW troffers offer a choice of 40-watt T-12 standard or instant-start bi-pin lamps, 38-watt Slimline, 54-watt Slimline, 75-watt Slimline, 40-watt T-17 low brightness, 85-watt Krypton, 20-watt T-12 lamps.

Troffers are available with 1, 2 or 3 lamps (except 5-ft. and 10-ft. units with 1 or 2 lamps only). One-lamp units are available in choice of Alzak or baked white enamel reflector; two and three lamp units with baked white enamel reflector.

Only MITCHELL UNI-FLOW has these time-saving, cost-cutting features

Write, phone or wire today for the complete facts about MITCHELL UNI-FLOW

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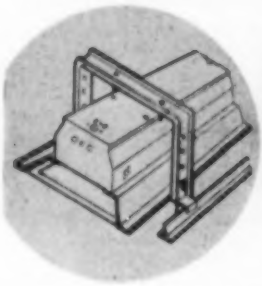
MITCHELL MANUFACTURING COMPANY
2525 N. Clybourn Ave., Chicago 14, Ill.
In Canada: Mitchell Mfg. Co., Ltd., 14 Waterman Ave., Toronto

ENGINEERING to the Nth POWER

In lighting as in aircraft the maximum degree of performance begins on the engineer's board. An exceptional recognition of Globe's engineering is implicit in the selection of Globe fixtures to light Convair's recently opened $3,000,000 Engineering Development Center.



Globe's UNG 503—96—430 troffers installed in this area result in an illumination level of 70 footcandles.

Globe's versatile UN mounting bracket is engineered for a variety of adjustments. Wing nuts move vertically on bracket legs.

Convair's YB-60 all-jet heavy bomber

Globe, too, has behind its finished product an engineering program to integrate design, research and development— all directed to achieve the maximum . . . the Nth Power.

Continuous runs of Globe's K402—96—430 provide an overall illumination of 70 footcandles.

No matter what the spacing of studs from which stems are supported, Globe's sliding grip hanger will move into correct hanging position.

We will gladly send, upon request, complete engineering details and lighting data on Globe fixtures installed in Convair's Engineering Development Center.

GLOBE
LIGHTING PRODUCTS, INC

2121 South Main Street Los Angeles 7, California
New York: 1710 Flushing Ave., Brooklyn

(Continued from page 14A)

lamps, but the nearest shell exploded 300 yards away.

"The reason that the Reds can't eliminate us," Conklin explained, "is that they can't find us. The lights are so strong that it's hard to tell where we are located. They may think we're on the next hill when actually we're 10 miles away."

There is one other light in Conklin's section, which is part of the 86th Engineer Searchlight Company. The two lamps can either beam directly onto the enemy or blanket an entire area by reflecting the beams off a layer of clouds. Range of the lights is 14 miles.

I.E.S. Panel Feature of A.I.E.E. Pacific Meeting

One entire session of the Pacific General Meeting of the American Institute of Electrical Engineers, held August 19 to 22 in Phoenix, Arizona, was devoted to Lighting (I.E.S.). The Friday session August 22 at the Westward Ho Hotel, featured conference papers by I.E.S. members. J. D. Whitnell, Chairman of the Arizona Chapter of I.E.S., presided at the session.

Papers presented at the lighting panel of the A.I.E.E. program included:

"Lighting Yesterday and Tomorrow," by Barney H. Hartley, Falcon Engineering, Phoenix, Ariz.

"Engineering Aspects of Illumination," by Benjamin S. Benson, Jr., Benjamin Electric Mfg. Co., Des Plaines, Ill.

Relief Sought for Critical Shortage of Engineers

The monthly bulletin "Engineering Manpower Spotlight" issued by the National Electrical Manufacturers Association, to inform management about engineering manpower developments, has given special attention of late, to the current shortage of engineers.

Each issue of the "Spotlight" has highlighted one important aspect of the shortage, or has discussed important related subjects. Copies of the bulletins may be supplied to management on request to N.E.M.A., 155 East 44th St., New York City.

October 15 Deadline for Application to Fulbright Awards

The 1953-1954 competition for Fulbright awards for university lecturing and post-doctoral level research in Europe and the near east was announced recently by the Conference Board of Associated Research Councils. Application forms and full information may be obtained from the Council's Committee on International Exchange of Persons, 2101 Constitution Ave., Washington 25, D. C.

Fulbright awards, in the currency of the host country, are made to successful applicants for university lecturers, research scholars and specialists and usually include: round trip transportation for the grantee; cost of living allowance; small supplemental allowance for travel and books. Among the subjects included are all phases of engineering. The competition is specifically for university lecturing and post-doctoral-level research. Graduate students desiring to enroll for courses abroad or to pursue a directed program of studies at the pre-doctoral

(Continued on page 21A)

LIGHTING CALENDAR

Society Events

September 8-12, 1952 — Illuminating Engineering Society, National Technical Conference, Edgewater Beach Hotel, Chicago, Ill.

October 9, 1952 — Meeting of I.E.S. Council, New York, N. Y.

December 11, 1952—Meeting of I.E.S. Council, New York, N. Y.

March 23-24, 1953—Canadian Regional Conference, Chateau Laurier, Ottawa, Ont. (Tentative)

April 13-14, 1953 — Southwestern Regional Conference, Hotel Baker, Dallas, Texas. (Tentative)

April 23-24, 1953—Pacific Northwest Regional Conference, Multnomah Hotel, Portland, Ore. (Tentative)

Week of May 6, 1953 — Midwestern Regional Conference, Minneapolis, Minn. (Tentative)

May 14-15, 1953 — East Central Regional Conference, Hotel Lord Baltimore, Baltimore, Md. (Tentative)

May 18-19, 1953 — Southern Regional Conference, Sedgefield Inn, Greensboro, N. C. (Tentative)

May 25-26, 1953 — Great Lakes Regional Conference, Syracuse Hotel, Syracuse, N. Y. (Tentative)

Industry Events

August 19-22, 1952 — Pacific General Meeting, American Institute of Electrical Engineers, Phoenix, Ariz.

September 8-10, 1952 — American Standards Association's Third National Standardization Conference, Museum of Science and Industry, Chicago, Ill.

September 8-11, 1952 — Institute of Traffic Engineers, Annual Meeting, Hotel Sherman, Chicago, Ill.

September 8-11, 1952 — Fall Meeting, The American Society of Mechanical Engineers, Sheraton Hotel, Chicago, Ill.

September 29 - October 2, 1952 — Annual Convention, International Municipal Signal Association, Inc., Hotel Statler, Boston, Mass.

October 1-3, 1952 — 8th Annual Meeting, Canadian Electrical Manufacturers Association, General Brock Hotel, Niagara Falls, Ont.

October 1-4, 1952 — 17th Annual Conference, International Association of Electrical Leagues, Radisson Hotel, Minneapolis, Minn.

October 6-10, 1952 — Annual Convention, National Electrical Contractors Association, Hotel Morrison, Chicago, Ill.

October 7-9, 1952 — Pacific Coast Regional Restaurant Convention and Exposition, Biltmore Hotel, Los Angeles, Calif.

October 13-17, 1952 — Fall General Meeting, American Institute of Electrical Engineers, New Orleans, La.

October 20-21, 1952 — National Farm Electrification Conference, Hotel Statler, Detroit, Mich.

October 20-24, 1952 — 40th National Safety Congress & Exposition of the National Safety Council, Chicago, Ill.

November 10-13, 1952 — National Electrical Manufacturers Association, Haddon Hall Hotel, Atlantic City, N. J.

November 17-19, 1952 — 39th National Foreign Trade Convention, Waldorf-Astoria Hotel, New York, N. Y.

November 18, 1952 — 34th Annual Meeting, American Standards Association, Waldorf-Astoria Hotel, New York, N. Y.

November 30 - December 5, 1952 — Annual Meeting, The American Society of Mechanical Engineers, Statler Hotel, New York, N. Y.

January 19-22, 1953 — Plant Maintenance Show, Public Auditorium, Cleveland, Ohio.

January 19-23, 1953 — Winter General Meeting, American Institute of Electrical Engineers, New York, N. Y.

March 9-13, 1953 — National Electrical Manufacturers Association, Edgewater Beach Hotel, Chicago, Ill.

March 30 - April 2, 1953 — Annual Sales Conference, Edison Electric Institute, Edgewater Beach Hotel, Chicago, Ill.

Week of May 24, 1953 — 45th Annual Convention, National Association of Electrical Distributors, Stevens Hotel, Chicago, Ill.

June 1-4, 1953 — 21st Annual Convention, Edison Electric Institute, Atlantic City, N. J.

June 29 - July 3, 1953 — Summer General Meeting, American Institute of Electrical Engineers, Atlantic City, N. J.

August 18-21, 1953 — Pacific General Meeting, American Institute of Electrical Engineers, Vancouver, B. C.

September 21-26, 1953 — 25th Jubilee Meeting, International Association of Electrical Inspectors, Edgewater Beach Hotel, Chicago, Ill.

September 23-25, 1953 — Annual Meeting, Canadian Electrical Manufacturers Association, General Brock Hotel, Niagara Falls, Ont., Canada.

October 19-23, 1953 — 41st National Safety Congress & Exposition of the National Safety Council, Chicago, Ill.

November 9-13, 1953 — National Electrical Manufacturers Association, Haddon Hall Hotel, Atlantic City, N. J.

January 18-22, 1954 — Winter General Meeting, American Institute of Electrical Engineers, New York, N. Y.

March 8-11, 1954 — National Electrical Manufacturers Association, Edgewater Beach Hotel, Chicago, Ill.

Smoke test proves new lamp stays bright!

▲

DIMMED BY FILM

The film from dirt, smoke and soot had lowered the light output of the conventional lamp and its reflector by 56%.

STAYS BRIGHT

The new Westinghouse R-57 lamp, with its built-in reflector, had lost only 15% of its light output! ▶

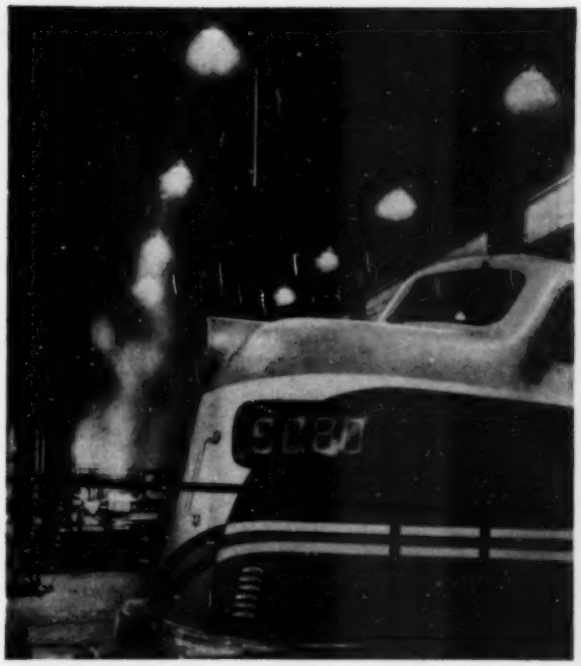
TESTED BY DIESEL SMOKE AND SOOT

Diesel engines belch oily smoke into the air. That's why a diesel engine roundhouse was chosen to test a conventional lamp with reflector, and a Westinghouse R-57.

Before the test, the light output of the lamp in reflector, and the R-57 were measured in a photometer. After hanging for one month in the high bay of the roundhouse, they were returned to the Westinghouse laboratories for another photometric reading.

YOU CAN BE SURE... IF IT'S

Westinghouse



You know the need, the advantages of good lighting in your plant. To keep the light level high, lamps and their reflectors must be cleaned. This is costly. Now Westinghouse solves both problems with its new R-57 lamp. Its built-in reflector is sealed against dirt, dust, and soot.

The Westinghouse R-57 saves cleaning costs. And every time you replace an R-57, you add a new, silvery reflector to your installation.

The Westinghouse R-57 550- or 800-watt comes with wide or narrow beam and will fit your standard sockets. And, it has a rated average life of 2000 hours! For more information, just mail coupon, or call your nearest Westinghouse Lamp Sales Office.

TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of political campaign over CBS television and radio.

WESTINGHOUSE LAMP DIVISION Dept. 1E
Bloomfield, New Jersey

I'd like more information about the new Westinghouse 550- and 800-watt R-57 lamps.

NAME .....

COMPANY .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

MORE THAN MEETS YOUR EYE

by Sam Hibben

LIGHT IS THE STAFF OF LIFE. Without sunlight, there would be no plant life, no food for animals. Light enables the green leaf to take carbon dioxide from the air and make plant tissue. The magic worker in all green plants is "chlorophyll," (which means *green leaf*). It exists in a thin skin around the earth—about fifty feet below the ocean's surface, to some three miles above it. Light and chlorophyll create the "bread" by which we all live. Strange, isn't it, that man has never learned to make the chlorophyll that makes his own life possible.

LIGHT IS AS INVISIBLE AS THE WIND. What we see is not light, but the objects that intercept or reflect light waves. And if objects did not break light down and send us portions of the spectrum, we would not know color. Ever think about the peculiar structural differences that make the red rose petals reflect light so differently from the white lily, or the blue violet?

BALANCING THE SPECTRUM. Mercury lamps are very efficient sources of light. But they give a greenish light, and are often paired with incandescents for color correction. Since the latter do not last as long, the labor cost of replacing them lowers the economy of mercury lighting. To correct this, Westinghouse balanced the mercury spectrum. The ultraviolet, normally wasted on the inside of mercury lamps, was simply put to work. In the new Westinghouse 1000-watt C-H12, and the 400-watt J-H1, the ultra-violet causes a special phosphor coating inside the bulb to fluoresce red. The light from the phosphor and the mercury vapor blend into a golden-white light of great efficiency.

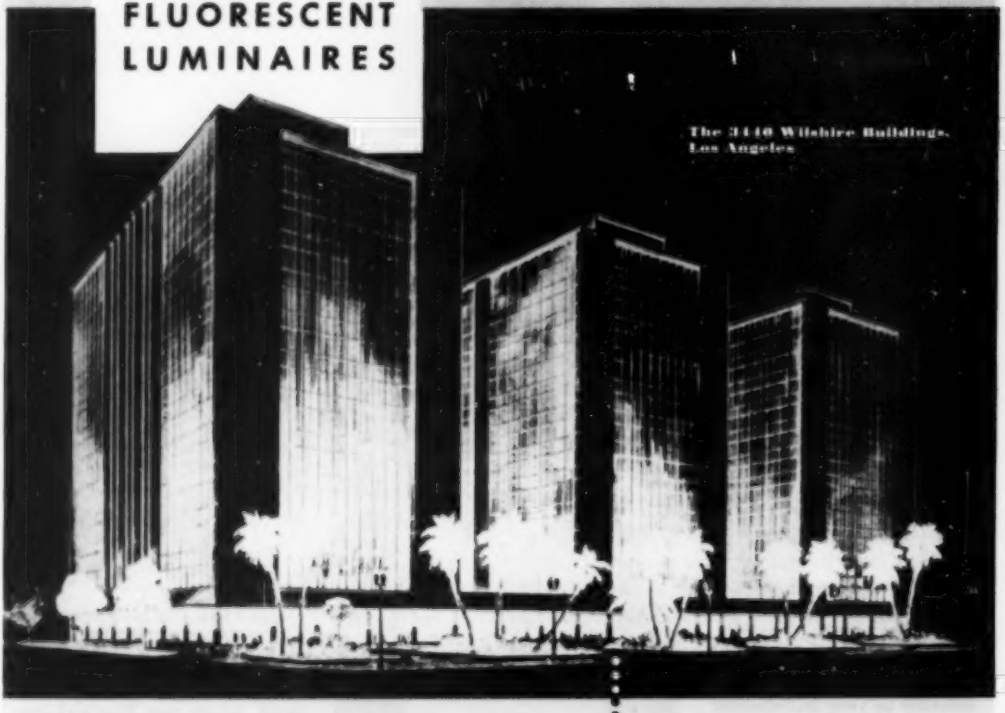
More next month.

Samuel G. Hibben

BUY NOW AND SAVE!
WESTINGHOUSE
FLUORESCENT LAMPS
STILL COST YOU LESS
THAN THEY DID
IN 1940, YET BURN
SEVEN TIMES LONGER!

36 STORIES

OF ALL-BRITE FLUORESCENT LUMINAIRES



The 3440 Wilshire Buildings, Los Angeles

another important move in western lighting

When Tishman of New York selected lighting fixtures for these triple 12-story modern office buildings at 3440 Wilshire Boulevard in Los Angeles, All-Brite Corsair luminaires were chosen for the entire job. High-quality, glare-free illumination is provided for 600,000 sq. ft. of office space by these modern, efficient fixtures. This marks another outstanding advance by All-Brite in the cause of good lighting for Western building. Architects: Claude Beelman and Herman Spackler; engineers: Brandow and Johnson; general contractor: C. L. Peck; electrical contractor: Fischbach and Moore. All are of Los Angeles.

NEW ALL-BRITE CATALOG — AVAILABLE ON REQUEST TO ENGINEERS, ARCHITECTS, BUILDERS, PURCHASING AGENTS

CORSAIR

a distinguished luminaire for contemporary interiors

Highly versatile, features Corning Albalite side panels. Die formed of heavy steel, finished in high-reflectance baked white enamel. Available with Corning glass bottom panel, or with new 35°-30° plastic louver. Two, three and four lamp fluorescent and slimline models in a complete assortment of lengths, all with same case width for flexibility and uniform appearance.

WRITE FOR SPECIFICATIONS, PHOTOMETRIC DATA AND INSTALLATION DETAILS.

FLUORESCENT FIXTURES OF CALIFORNIA

All-Brite

san francisco: **3320 · 18TH STREET**
los angeles: **613 IMPERIAL STREET**
portland: **1318 S. W. FIRST AVE.**

(Continued from page 17A)

level should apply to their local Fulbright Adviser or directly to the Institute of International Education in New York City, N. Y. Applications for university lecturing and advanced research must be postmarked no later than October 15, 1952.

Included in the competition are awards for Austria, Belgium and Luxembourg, Denmark, Egypt, France, Greece, Iraq, Italy, Netherlands, Norway, Turkey, United Kingdom and colonial dependencies. A Fulbright Agreement has also recently been signed with Japan, Pakistan and the Union of South Africa.

I.E.S. PROJECT of the type meeting with special success was this Lighting Design Competition for Architectural Students conducted by Southern California Section in cooperation with A.I.A. Winners are here displayed in the windows of the main office of the Dept. of Water & Power, Los Angeles.

Program Ideas for Incoming I.E.S. Officers

A more or less careful review of I.E.S. Section and Chapter meeting programs versus post-meeting reports as received at headquarters, indicates a certain trend of success, for some types of I.E.S. programs. Programs which have met with favor, in terms of attendance, interest of the Press, and/or service to members or the industry seem to be: 1. "Road Shows" of national conference features. 2. Extension meetings organized by and held in towns other than Section headquarters. 3. Clinics on specific phases of lighting practice, organized in advance to attract non-members in related fields. 4. Joint meetings with other Sections or Chapters. 5. Joint meetings with I.E.S. Committees. 6. New developments in the lighting field presented by an expert. 7. Education of the local membership in I.E.S. services.

Projects which have met with special success have been: 1. Illumination courses. 2. Clinics and one-day or more Forums on various phases of lighting. 3. Architectural contests and other organized cooperation with the architects' groups. 4. Contests for interesting installations. 5. Young members' night, featuring technical papers by younger local members, with prizes for those judged best. 6. Local papers committees for stimulating and reviewing papers for possible publication. 7. Study Clubs.

Displays pointing up Society publications, I.E.S. services to Sustaining Members, and benefits to members have been worthwhile projects in several Sections.

A contributing factor toward the success of either program or project seems to have been advance organization by an active committee chairman appointed specially to see the job through.

Tentative Schedule—I.E.S. Regional Conferences, 1953

Canadian	Chateau Laurier Ottawa, Ont.	March 23-24
Southwestern	Hotel Baker Dallas, Tex.	April 12-14
Pacific Northwest	Multonomah Hotel Portland, Ore.	April 23-24
Midwestern	Minneapolis, Minn.	May 7-8
East Central	Hotel Lord Baltimore Baltimore, Md.	May 14-15
Southern	Sedgefield Inn Greensboro, N. C.	May 18-19
Great Lakes	Syracuse Hotel Syracuse, N. Y.	May 25-26

National Home Lamp Council Established

Portable lamp manufacturers, representing the Chicago, Los Angeles, New York and Philadelphia locals of the Lamp and Shade Institute of America, have announced the formation of the National Home Lamp Council and the beginning of an extensive public relations program for the industry, to be conducted by the Council. George H. Weiner, president of Deena Products Company of Chicago, is chairman of the National Home Lamp Council, which is endorsed by the Lamp and Shade Institute of America. Others on the board of directors of the new group are Ben Glassman of the Rembrandt Lamp Corp., Chicago; Fred Phillips of the Stiffel Co., Chicago; Bernard Roberts of Modeline Co., Los Angeles; Sam Ruby of Argo Lamp Corp., Philadelphia; Al Sandel of Sandel Manufacturing Co., Chicago; and Morris Thau of Mutual Sunset, New York.

Bibliography on Lighting Available from Headquarters Office

A list of books, publications and periodicals, compiled and kept up-to-date by the I.E.S. Committee on Lighting Education, is available from the Technical Department at I.E.S. headquarters office. Consisting of nine mimeographed sheets, this bibliography on light and lighting covers publications which make a definite contribution to the field of illumination,

(Continued on page 22A)

(Continued from page 21A)

grouped according to the subject matter which they represent.

These sections are (1) Lamps and Lighting, (2) Architecture and Lighting, (3) Physics of Light—Optics, (4) Color, (5) Light, Eyesight and Health—Related Psycho-Physiological References, (6) Trade Papers and Professional Journals in both English and foreign languages.

IT SEEMS TO ME

Rating Fluorescent Lamps in Volts?

In the July issue of ILLUMINATING ENGINEERING, under the department, "Questions and Answers on Light Sources," the answer to the question," "Why Aren't Fluorescent Lamps Rated in Volts," is very much in error since the ballast in no way determines the voltage of the lamp.

The voltage characteristic of the lamp is determined by the internal conditions in the lamp, such as type of carrier or filling gas, gas pressure, lamp shape, size, type of electrodes, how the lamp has been evacuated and cleaned up during the manufacturing process. In addition, they are affected by external temperature, relative humidity and the distance of the lamp to the fixture or grounded conductor. Once the lamps are conducting at a given current, a gaseous discharge design becomes essentially a constant voltage device.

To my knowledge lamps *are* rated in starting voltage (both minimum and maximum in the case of prehent lamp), operating voltage, starting current, operating current and lamp wattage, and are covered in detail by proposed American Standard C78.

Lamp manufacturers have agreed on the necessary open circuit voltage for striking or starting a lamp that is sufficiently high to insure consistent operation under all of the variable conditions. This voltage can be considered as a maximum voltage necessary to start lamps. Similarly, ballast manufacturers have agreed to provide in ballasts this voltage as a minimum ballast voltage. In other words, what is a maximum voltage for the lamp manufacturer is a minimum voltage for the ballast manufacturer. The ballast must also limit the current of the lamp at the value of current specified by the lamp manufacturer. — H. U. HJERMSTAD, *Vice President, Sola Electric Co., Chicago, Ill.*

*Page 409, July ILLUMINATING ENGINEERING.

ABOUT PEOPLE

Warren B. Reese has been appointed General Sales Manager of the Macbeth Corporation and its subsidiaries, in Newburgh, N. Y.

Marvin V. Westrick has been appointed senior engineer for the Michigan sales division of Westinghouse Electric Corp., Lamp Division. Mr. Westrick will have headquarters in Detroit.

Officers have been elected for the National Association of Electric Distributors at their 44th annual convention. **George P. Hessler,** vice-president, Graybar Electric Co., Inc., New York, was elected as president. **L. E. Barrett,** president of Barrett Electrical Supply Co., St. Louis, was elected vice-president and chairman of the Apparatus and Supply Division. **Benjamin Gross,** of Gross Dictributors, New York, was re-elected vice-president and chairman of the Appliance Division.

Philip R. Blackburn has been appointed apparatus and supply manager for the Middle Atlantic District of Westinghouse Electric Supply Co., with his headquarters in Philadelphia. He replaces **Charles R. Lee,** who has resigned due to family health reasons.

Edward L. Duggan has been named District Sales Manager of Champion Lamp Works for the New York area, operating out of the New York City office at 420 Lexington Ave.

L. F. Hickernell, chief engineer of the Anaconda Wire & Cable Co., has been named chairman of the newly formed Committee on Technical Operations of the American Institute of Electrical Engineers. The new committee will be coordinating agency for the association's five technical divisions.

A. A. Jones has been re-elected to the post of secretary of the New York District Council of the American Society for Testing Materials. He has also been re-elected secretary of the A.S.T.M. Committee on Wires for Electrical Conductors.

BOOKS AND PAMPHLETS

*Books whose reviews are marked * are available for inspection at Headquarters Office, Technical Dept.*

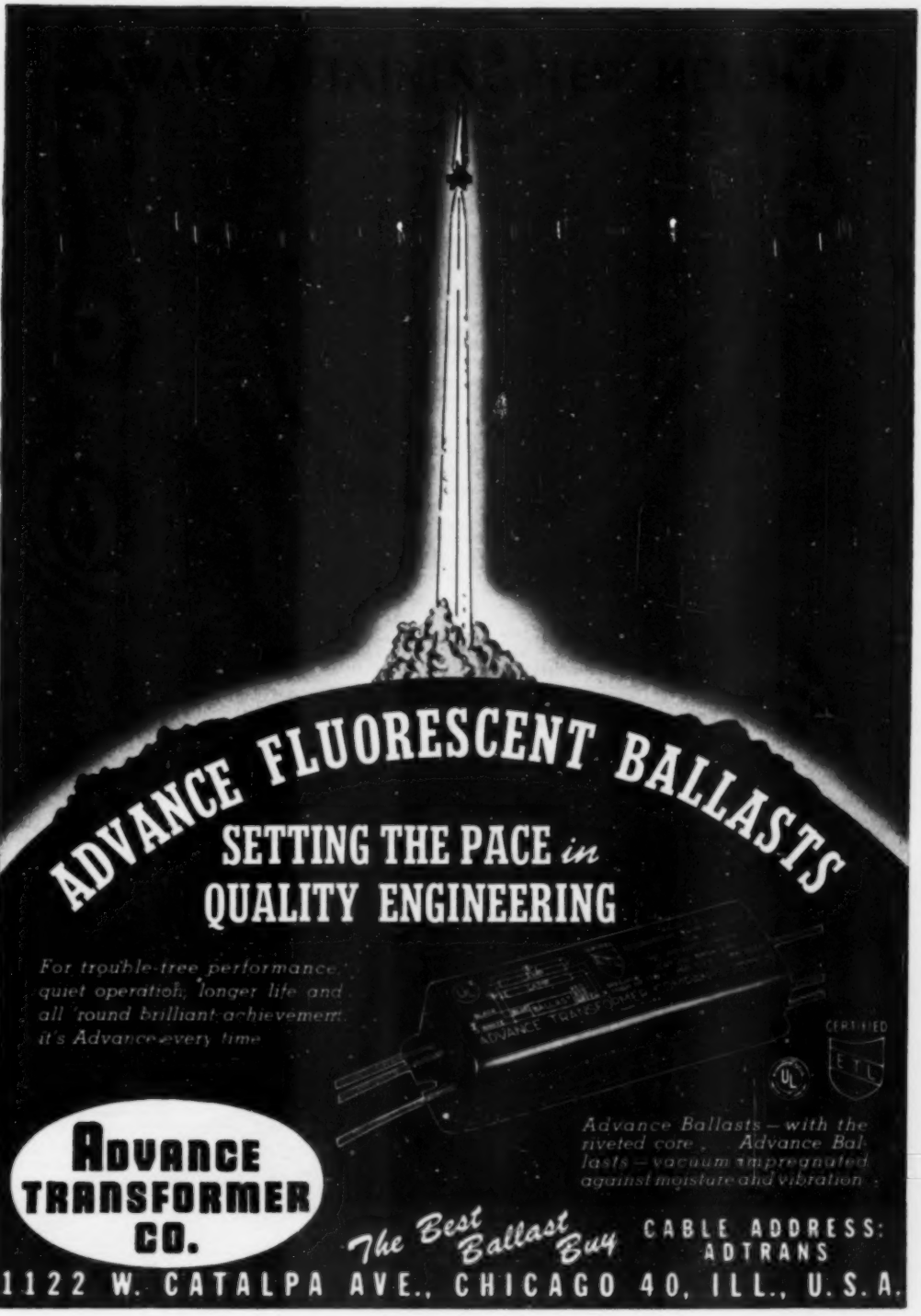
***Color in Business, Science and Industry** by Deane B. Judd, published by John Wiley and Sons, Inc., New York City, 1952; 410 5¾ x 9 inch pages, 106 illustrations; $6.50.

This book deals primarily with color inspection, measurement, and control. Even though much of the material is highly technical Dr. Judd has treated it in a down-to-earth manner most of which should be understandable to everyone seriously interested in color. Since color plays such an important role in the world of today this excellent first-of-its-kind volume should find a wide audience.

Topics treated include an explanation of the eye, basic aspects of color, color matching, defective color vision, spectrophotometry, colorimetry, reproduction of

(Continued on page 47A)

GAVEL is presented by R. R. Lusk, retiring chairman of the Chicago Section to his successor, W. A. Weibel. J. B. Chambers, newly elected vice-chairman (extreme left) and A. P. Larson, incoming secretary, witness the ceremony.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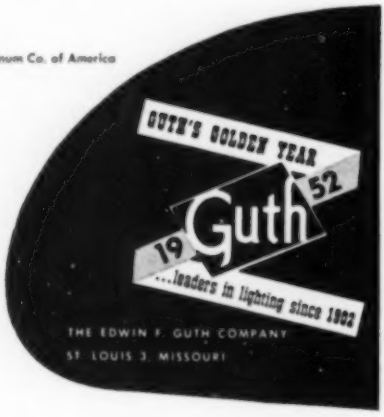

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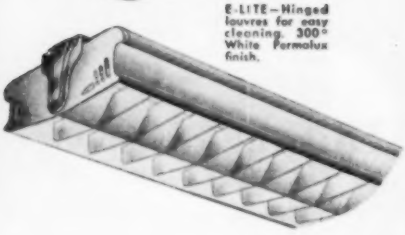

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(*Continued on page 26A*)

(*Note:* Names of Official Representatives appear in italics.)

(Continued from page 25A)

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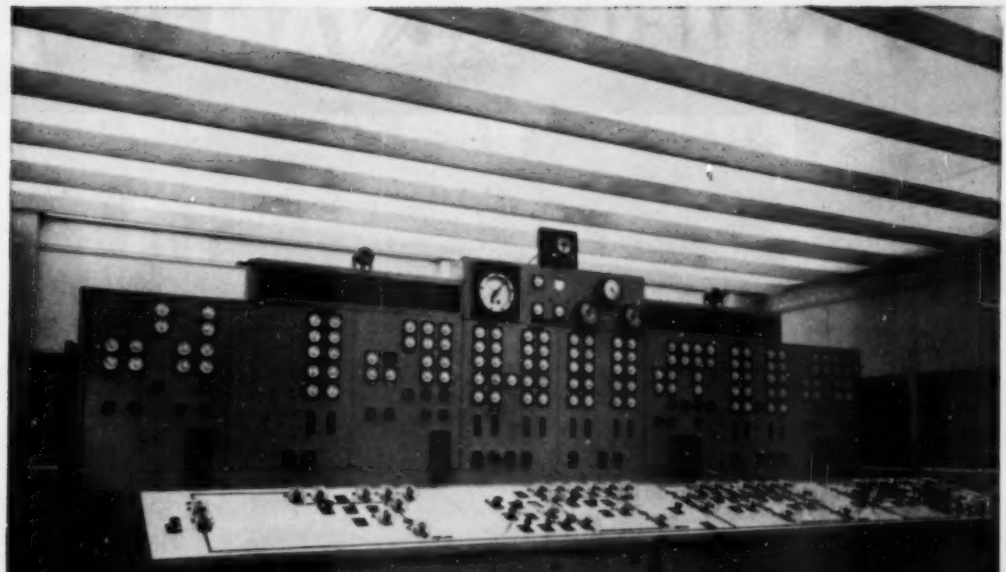
(Continued on page 41A)



Every Dial Instantly Readable Under a Wakefield Ceiling

Total Area:
Approximately 1,325 Square Feet

Location:
Central Control Room of a Turbine Room

Designed Initial Illumination Level:
95 footcandles

Designed Working Illumination Level:
55 to 60 footcandles

Lamps Used:
72" and 96" T-12 430 MA lamps

Consulting Engineers:
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Licensed Agent:
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This is the central control room of the turbine room of a large midwestern manufacturer of electrical equipment. A Wakefield Ceiling provides virtually perfect seeing conditions for quick, accurate dial readings. Light is diffused so evenly through the corrugated Plexiglas "ceiling" that both direct and reflected glare are for all practical purposes non-existent.

Not only is light controlled by this Wakefield Ceiling but sound and air diffusion as well. Suspended acoustical baffles furnish excellent sound absorption; and conditioned air is delivered into the room through the multiple openings at the edges of the corrugated Plexiglas diffusers. The Wakefield "Three-Way" Ceiling is a revolutionary development in environmental control. For a detailed, illustrated booklet, complete with working drawings, write to The F. W. Wakefield Brass Company, Vermilion, Ohio.

Wakefield **Over-ALL Lighting**

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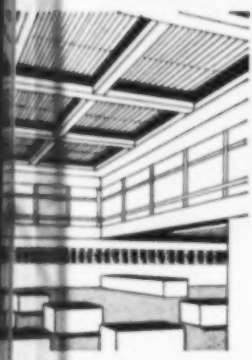
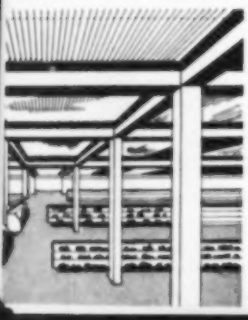
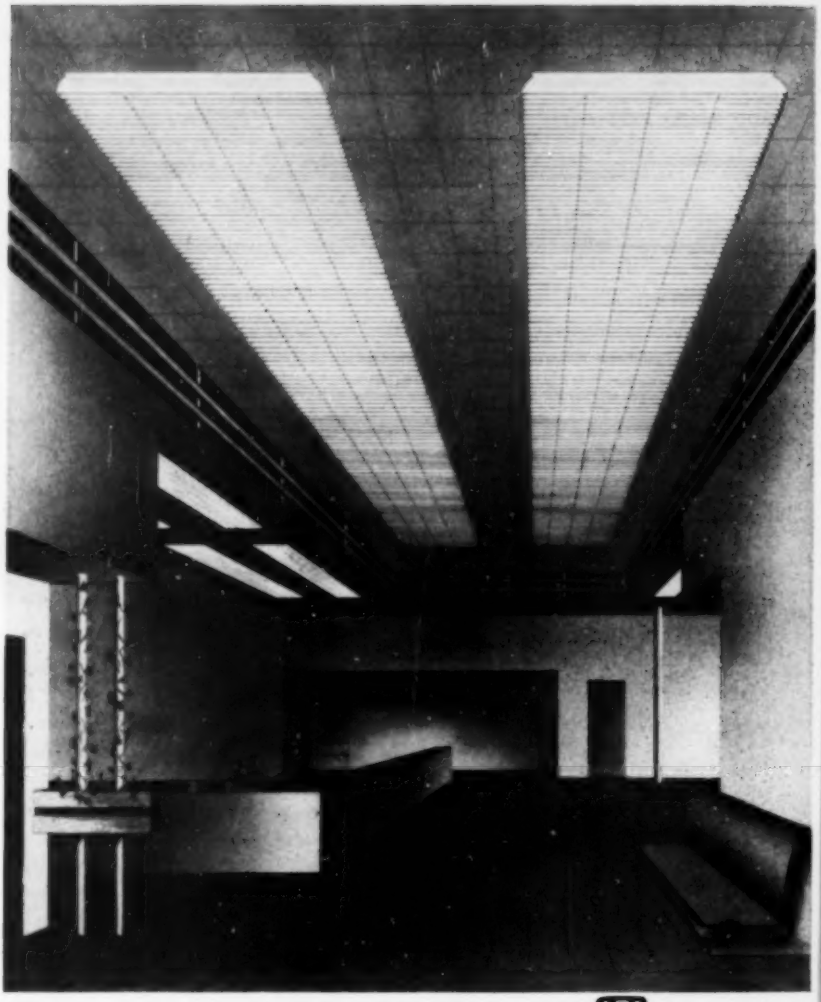






Note exclusive features of this new LPI invention

- Large area light source, very shallow, highly stylized.
- Priced comparably to standard width fixtures.
- Shipped completely assembled in one carton, ready to install, installation costs reduced to minimum.
- Each louver removed separately for jiffy-quick cleaning.
- Can be surface, suspension, or recess mounted.
- Fixtures can be joined endwise or sidewise, or both, for large interesting panels of light.
- As a louveral system AREALUX is completely *self-contained*, the first unit of its kind.
- Highly efficient when used individually or in various combinations.
- Perfect alignment is provided by ingenious hanger arrangement and accessories with AREALUX.
- Completely wired with E.T.L. and U.L. approved ballasts. U.L. approved and I.B.E.W. A.F.L. Union Label.

LARGE AREA LUMINAIRES

LPI AREALUX

Architects and illuminating engineers, as you know from your own experience, have found that in large, massive interiors or in high ceiling areas, old-style standard narrow fixtures are far from satisfactory.

The result is an ever-growing demand for panel, louverall, and grid lighting. Now, at last, LPI answers this demand with AREALUX—a new and original invention inspired by ideas submitted to us by a host of architects.

LPI AREALUX is not only an exceptionally handsome fixture. By simulating with great fidelity the high qualities of natural daylight, it provides lighting that is ideal for working conditions in offices, stores and show rooms.

New LOW in cleaning costs

The AREALUX is 100% *cleanable,* as you will see in the two photographs below.

The panels, after being easily unhinged from the fixture, are then laid on the table face up, and then each louver comes out with fingertip pressure.

The now-famous LUV-R-LOX invention makes possible this new LOW in cleaning costs. Think of it! The time needed for cleaning the entire AREALUX fixture is only 5 to 10 minutes—about 1/10 the time and effort of an old-style fixture of equal size!

And you know how important it is to keep louver fixtures shining clean. Soiled, dusty, grimy fixtures often deliver less than half their potential in foot candles.

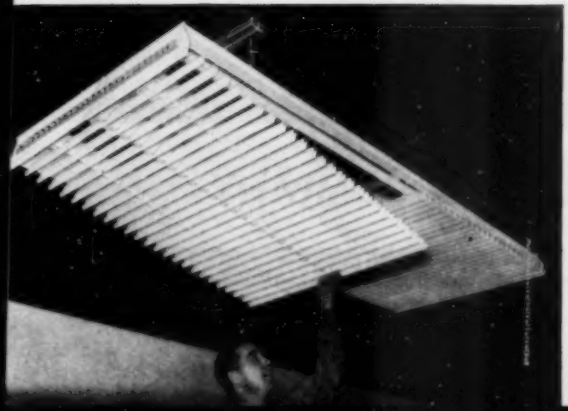
Write for FREE Catalogue

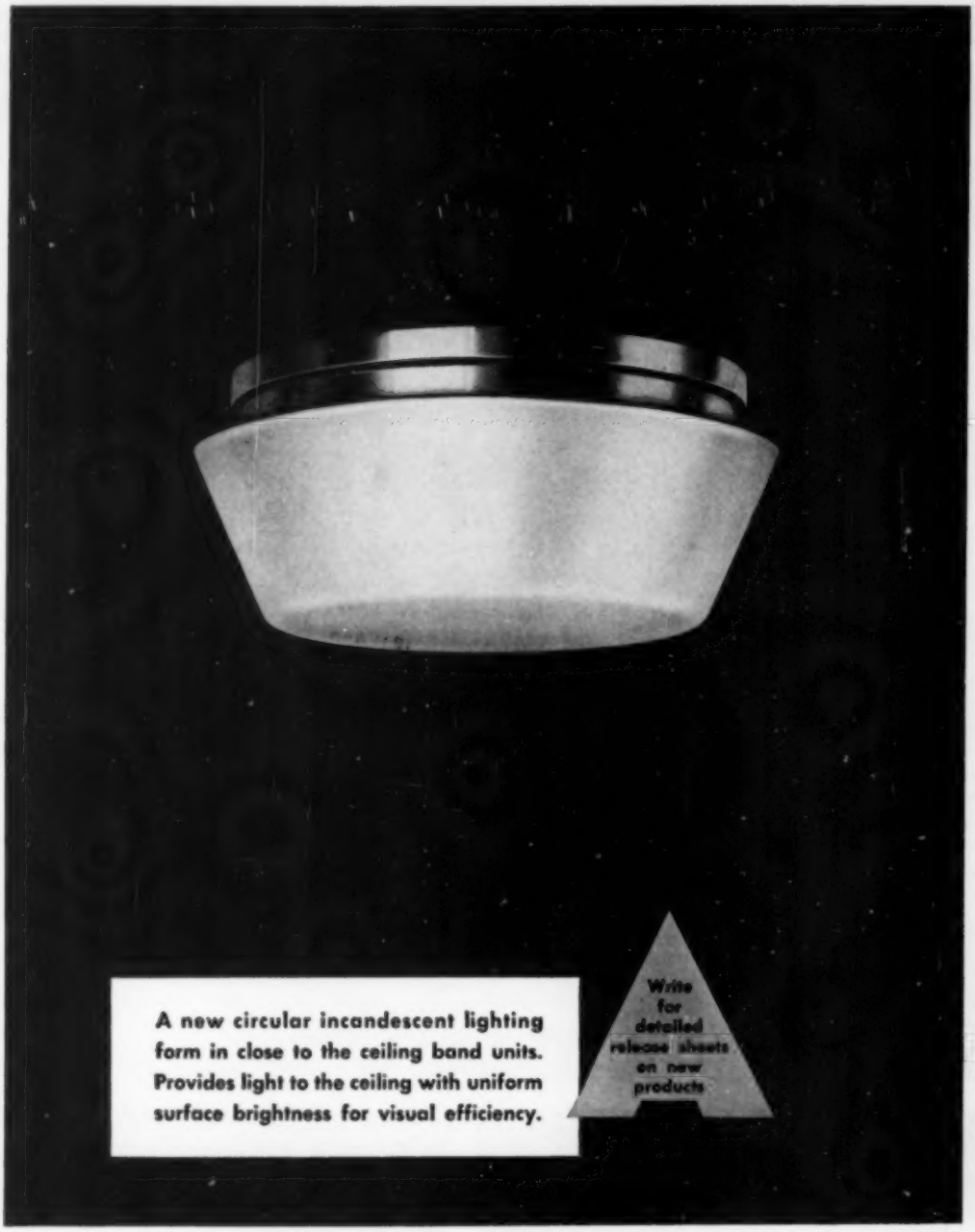
LPI's new deluxe 60-page catalogue—*"New Ideas in Fluorescent Lighting"*—contains full information regarding the AREALUX, installation details, photometric data, assembly instructions, full description of technical features. Graphically illustrated with photographs and diagrams. Write on your letterhead for your FREE copy—*now.* Ask for Catalogue No. 50-C.

LIGHTING PRODUCTS, Inc. HIGHLAND PARK ILLINOIS

For information on other LPI fixtures, see our Catalogue in Sweet's File

SEE OUR CATALOG IN SWEET'S FILE




A new circular incandescent lighting form in close to the ceiling band units. Provides light to the ceiling with uniform surface brightness for visual efficiency.
Write for detailed release sheets on new products

THE ART METAL COMPANY

CLEVELAND 3, OHIO

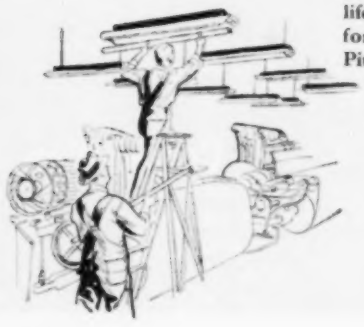
Manufacturers of Engineered Incandescent Lighting

The Only Ballast of its kind

NEW LEAD-LAG SLIMLINE BALLAST

- **Small as a series ballast**
- **Economical as a series ballast**

Compare size, weight, price and power loss to a series ballast—then *add* longer lamp life, better maintenance, positive stroboscopic correction. That's the new Westinghouse LEAD-LAG ballast now available for all slimline lamps. No more lamp replacement guesswork . . . full-rated lamp life . . . more satisfied slimline customers. Get the whole story. Send for B-5614, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-04315



YOU CAN BE SURE... IF IT'S

Westinghouse

LIGHTING DIVISION

Edgewater Park, Cleveland, Ohio

for lighting installation-

Electro Silv-A-King

Commercial Fluorescent A complete range of models in all sizes . . . Regular, Rapid Start and Slimline. Illustrated is the SKYLOUVER. Water thin with plastic molded louvers that won't warp, crack, chip, or discolor . . . one of the famous "Basic Unit" series offering complete interchangeability of seven different louvers on the same basic chassis.

Industrial Fluorescent R.L.M. Heavy duty, economically priced units for every purpose . . . designed to enhance appearance, efficiency and incorporating many advanced engineering features for easier installation and maintenance. Available in a complete line of Regular, Rapid Start and Slimline.

Incandescent Lighting R.L.M. For industrial and commercial applications, athletic fields, etc., including open and closed units, flood, spot and portable lights . . . and a complete line of accessories.

Architects, contractors and builders are now utilizing ELECTRO SILV-A-KING as one of their most important basic sources for every lighting fixture need.

The combined, comprehensive facilities of this new organization with over 50 years of experience . . . and an extensive, nation-wide network of sales offices staffed by experienced lighting engineers offers new, important assistance in planning and supply for every type of job.

Two strategically located manufacturing plants insure rapid, economical delivery throughout the country.

Plan now for easier, better lighting installations. Contact your local ELECTRO SILV-A-KING sales office or write direct to...

Corporation

Factories and Main Sales Offices:
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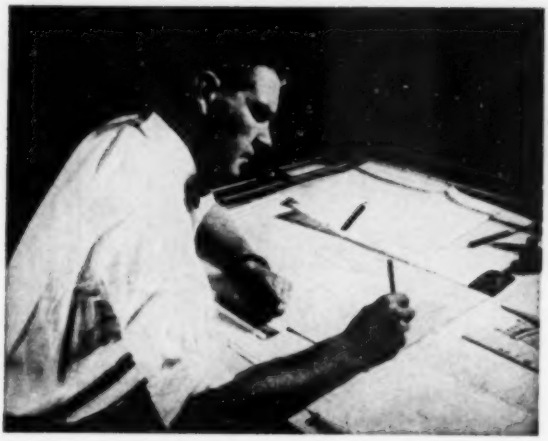
Stop bothersome blink-blink-blink

WITH WATCH DOG NO-BLINK FLUORESCENT STARTERS



- Watch Dog® starters *stop blinking* by automatically turning off a failing fluorescent lamp.
- Watch Dog starters *keep the lamp off* until the red reset button is pushed when new lamp is installed. No recurring blinking every time lights are turned on.
- Watch Dog no-blink starters *outlast* ordinary starters by as much as 10 to 1. With Watch Dog starters, ballasts last longer, too.

®Registered Trade-mark General Electric Company

Nothing creates dissatisfaction with a fluorescent fixture like a blinking lamp. *You* are the one who can prevent this. For the luminaires or installations that you design, specify General Electric Watch Dog no-blink starters.

By insisting on Watch Dog starters, you also help your client make an important saving in maintenance by cutting replacement costs of both starters and ballasts. More than 40 million Watch Dog starters have been sold to date. Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

GENERAL ELECTRIC

For all replacement needs—use the famous Watch Dog no-blink starter with the red reset button.

And here is the tag to look for when you buy fluorescent fixtures. It is your guarantee that the fixture has been equipped with G-E Watch Dog no-blink starters.

where sustained
"good seeing" is a must . . .

CHOOSE GARCY'S VISUALIER

MORRISON STEEL PRODUCTS, INC.
Buffalo, N. Y.

Architect:
Morton G. Wolfe
Buffalo, N. Y.

Distributor:
General Electric Supply
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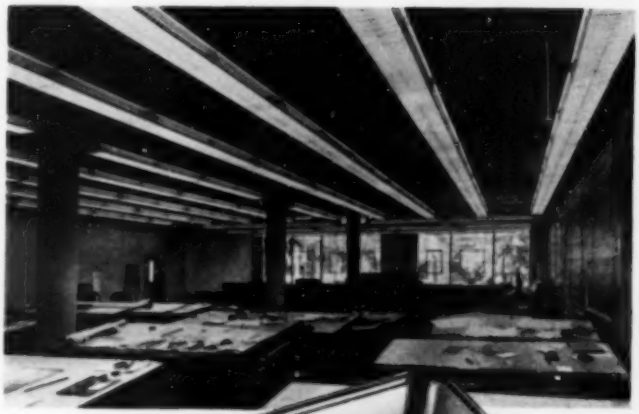
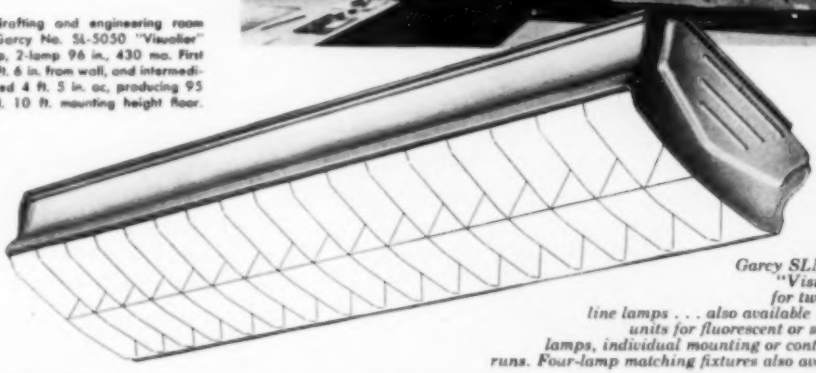


(Right) New drafting and engineering room lighted with Garcy No. SL-5050 "Visualier" with closed top, 2-lamp 96 in., 430 ma. First row spaced 1 ft. 6 in. from wall, and intermediate rows spaced 4 ft. 5 in. oc, producing 95 FC maintained. 10 ft. mounting height floor.



Garcy SLN-5050
"Visualier"
for two slim-line lamps . . . also available in 4 ft. units for fluorescent or slimline lamps, individual mounting or continuous runs. Four-lamp matching fixtures also available.

I.E.S. MEMBERS
•
YOU ARE CORDIALLY INVITED
to visit Garcy when you are meeting in Chicago this month.

GARCY'S "VISUALIER" *minimizes visual fatigue*

Comparison proves it! Garcy's Visualier excels in creating the conditions required for sustained good seeing . . . efficient light utilization, uniform light distribution, adequate shielding and low surface brightness. Of equal importance, high level lighting efficiency can be readily maintained. The large louver cells are easily cleaned from the floor with a brush or vacuum. All-metal construction means no breakage or warping. Detailed literature and E.T.L. data sent on request.

GARCY

GARDEN CITY PLATING & MFG. CO.
1760 N. Ashland Ave., Chicago 22, Ill.

New Garcy Lighting Equipment Catalog Now Available

CORNING LENS PANELS

Put the *right* light where it is needed

Here's how you can give your customers smooth, evenly distributed light with carefully controlled brightness. New Corning Lens Panels with Fresnel design lenses eliminate shadow and glare—direct light where it is needed.

Light in weight and easy to handle, Corning Lens Panels are made in long lengths, making possible attractive, continuous runs with a minimum of unsightly butts and light leakage. Their light weight also keeps shipping, fixture, and installation costs low. What's more, these lens panels are non-color selective. They transmit true color from the light source, showing off merchandise or putting employees in natural surroundings where they look better and feel better.

Corning Lens Panels are available in two different types: Lightweight Flat, in the Unilens and Twinlens patterns, and Lightweight Curved. Get the facts on this highly efficient engineered lighting glassware and what it can do for you. Mail the coupon today.

CORNING "Lightweight" Curved Lens Panel is a single piece unit. Open and closed end panels are stocked in a range of sizes. Special dimensions on request.

CORNING TWINLENS Panel, for two to four tubes, provides high lighting efficiency. Fluted rear surface intercepts light, prevents transmission of lamp image.

CORNING UNILENS Panel, for use with one or two fluorescent tubes. Single lens directs light where desired, while brightness at edges is controlled.

CORNING GLASS WORKS
CORNING, NEW YORK
Corning means research in Glass

CORNING GLASS WORKS, Dept. IE-9, Corning, N. Y.

Please send me your Catalog LS-32 "Corning Glassware for Fluorescent Lighting."

Name_____ Title_____

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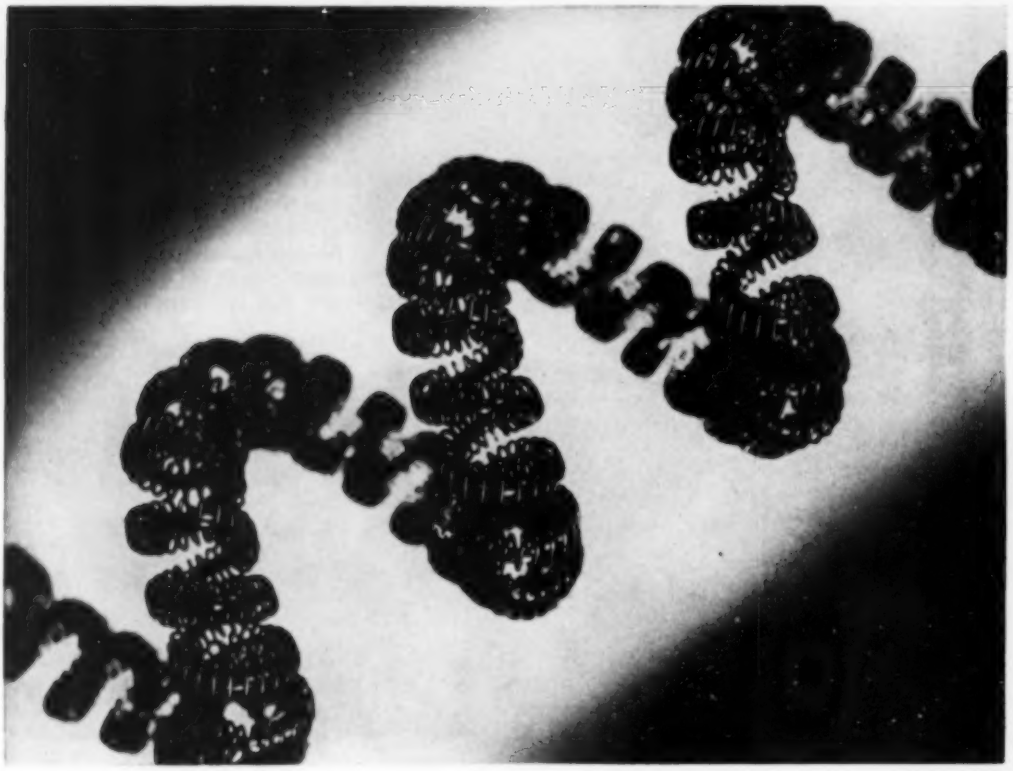
New G-E fluorescent lamp starts fast, needs no starter



THE triple coil filament developed by General Electric, and shown greatly magnified above, now makes possible another great new fluorescent lamp! It's the G-E RAPID START fluorescent lamp. Combined with General Electric's new RAPID START ballast, it starts with quick 1-2 action. There's no starter needed, so maintenance is easier, costs less. Flicker is eliminated. Hum is reduced to a minimum.

G-E RAPID START fluorescent lamps will be available soon. This newest development of General Electric research is another reason why you can *expect* the best value from G-E fluorescent lamps.

You can put your confidence in—

GENERAL ELECTRIC

here it is!

A COMPLETELY NEW APPROACH TO OVERALL LIGHTING...

Smithcraft area illumination

NOW . . . advanced design fulfills all the possibilities and benefits promised by overall lighting! Smithcraft Area Illumination is a complete fluorescent lighting system free from all the limitations and mechanical difficulties of previous attempts, yet it is not "custom built" to each installation. Skillfully engineered with unbelievable simplicity, Smithcraft Area Illumination when installed becomes a lighting "fixture" of limitless dimensions, shapes and patterns with unrestricted selection of shielding media and varied intensities within the system. For those who plan, recommend and install, here is an important new tool and business-producer; for the user, Smithcraft Area Illumination opens up exciting new possibilities for effect combined with illumination of unequalled quality.

architects

To the architect, **Smithcraft Area Illumination** presents a new opportunity for freedom of expression in the integrating of lighting interiors within interior design. Here is freedom of choice with no restrictions as to **size, pattern, intensity, shielding,** and **periphery.**

engineers

Engineers can now specify **and get** any required level of intensity. Or **different** intensities for different sections of an installation may be recommended to permit optimum usage of store or office areas. Alternating light, rows of lighting, or banks of lighting are possible because of flexibility of switching and a specially designed wiring system.

contractors

Ease and economy of installation are truly amazing! **Smithcraft Area Illumination** is actually installed in far less time than any combination of ceiling and illumination currently available. No careful dimensioning is required and no special tools, rules, or gadgets. From the time the hangers are in position on the ceiling to the finished installation, only a water level and small screwdriver are required.

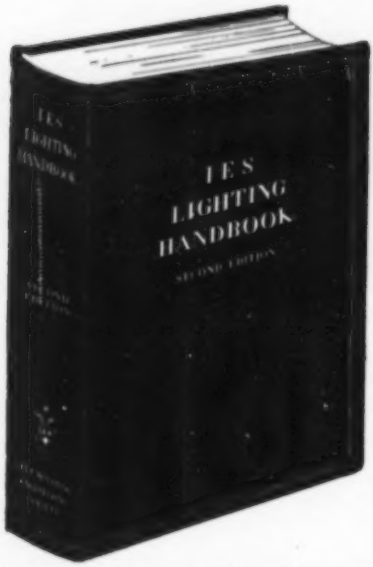
owners

For those who own buildings and businesses of many kinds, **Smithcraft Area Illumination** is a **profitable** and practical investment. Versatile and adaptable, here is highest quality illumination combined with appearance and effect that **sells** and **produces.** Its ease of maintenance and adaptability to future plans and developments are factors that interest any businessman. Yet, its initial cost is comparable to that of a suspended ceiling and troffer system.

America's finest fluorescent fixtures **Smithcraft**
LIGHTING DIVISION

Send now for further information on Smithcraft Area Illumination.

Now That You Have Seen It . . .



We feel sure you want to have as soon as possible your own personal I E S member copy of the . . . .

New Second Edition

IES LIGHTING HANDBOOK

Check the Handbook's value to you, look over the

- **987 pages . . . beautiful maroon binding**
- **18 technical reference and application sections**
- **Complete appendices furnishing all kinds of data you use regularly**
- **655 photos, drawings, lighting tables, charts**
- **Complete index fully cross-referenced for quick and easy use**
- **Manufacturers' product section**

A brand new library copy of the Handbook has been sent to the Chairman of every I.E.S. Section and Chapter. Every Society member has the opportunity to fully examine the new volume . . . to handle it . . . to check over the sections of particular value to him. Now you can see for yourself how readable and useful is this new book; how much improved are the new larger photographs on finer quality paper.

The Second Edition, IES LIGHTING HANDBOOK cannot be matched for its thorough, authoritative information on all phases of lighting art and application. For anyone to whom lighting is the whole or part of the daily work, the new Handbook is an extremely valuable working tool.

Price only $5.50 for one copy to I.E.S. members, if you have not already ordered at the pre-publication price.

To — ILLUMINATING ENGINEERING SOCIETY
1860 Broadway, New York 23, N. Y.

Send me promptly my member copy of the new IES LIGHTING HANDBOOK at the special member price for one copy at $5.50, saving me $2.50 over the regular $8.00 price.

☐ My check (money order) enclosed. ☐ Bill me.

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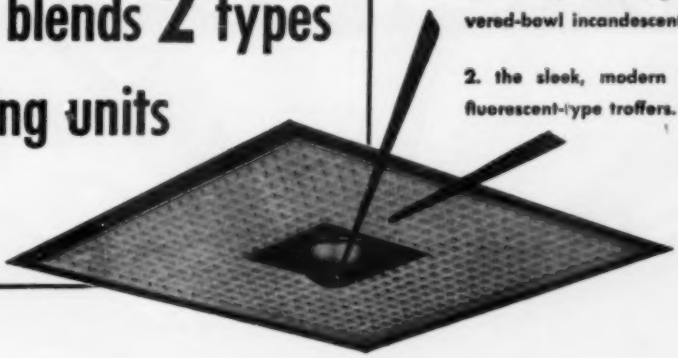
NOTE: If you care to send along payment with this order and so save the Society bookkeeping expense, your courtesy will be sincerely appreciated.

Order Now—

Over half the first printing of the new IES LIGHTING HANDBOOK has already been ordered. We believe seeing the book will stimulate sales of others. Better order your copy now!

Use Coupon

Skylike blends 2 types of lighting units into 1



1. the soft, indirect light of silvered-bowl incandescent lamps.

2. the sleek, modern look of fluorescent-type troffers.

Silvray SKYLIKE lighting offers advantages found in no other system, yet uses only silvered-bowl incandescent lamps.

Designed along modular concepts for recessed or semi-recessed use, SKYLIKE fixtures may also be surface-mounted in old or remodeled interiors without sacrifice in lighting quality.

Silvray SKYLIKE units are amazingly economical in initial cost – only ½ to ⅓ as much as other equipment delivering comparable results. Ease of maintenance permits similar savings – units can be relamped from the floor and require only an occasional cleaning with a damp cloth.

SKYLIKE fixtures fit 24" x 24" ceiling tile . . . are light in weight, easy-to-handle, and require only minimum framing support.

Here's *real proof* of SKYLIKE efficiency . . . unretouched photographs demonstrate the versatility of the SKYLIKE louvered incandescent lighting system. In each case, the only light source used was that of the SKYLIKE units — note the soft, even distribution of light . . . the complete absence of glare, harsh shadows, and sharp light cut-off lines.

Photo by Milton Mann Studios

A unique SKYLIKE application is pictured here in the showroom of Irving A. Belking Furs in San Francisco, California.

Notice how architect Bernard J. Saboroff's gridwork of 1 x 6 pine serves to hide the unsightly high ceiling, as well as to support the patterned group of recessed Silvray SKYLIKE units. Low brightness levels and 90° shielding provide an extremely satisfactory result.

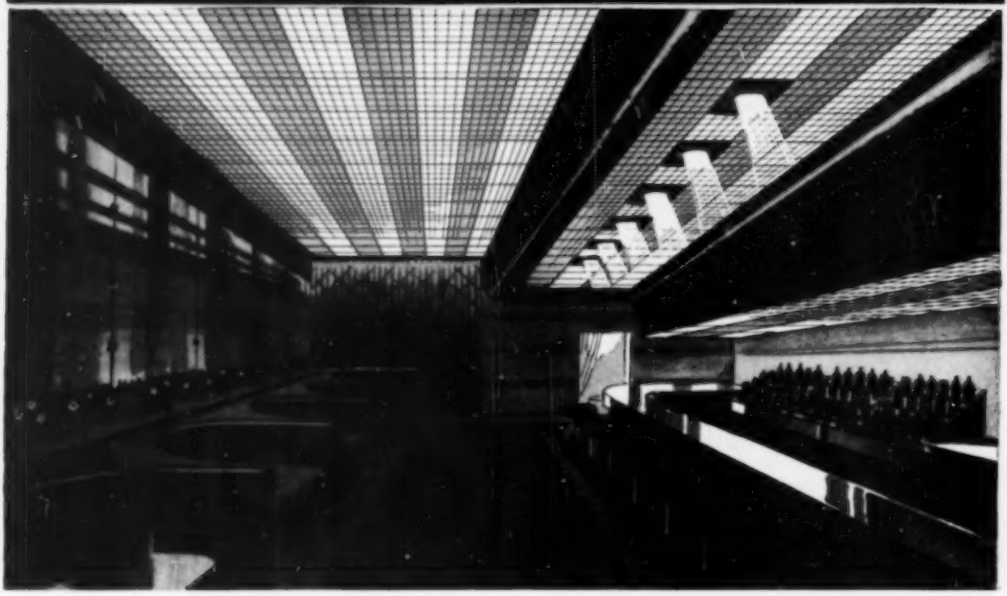
Selected for warm color and ease of installation, surface-mounted SKYLIKE units replaced out-moded globe-type units in the remodernization of the Levy Brothers Store in Elizabeth, N. J.

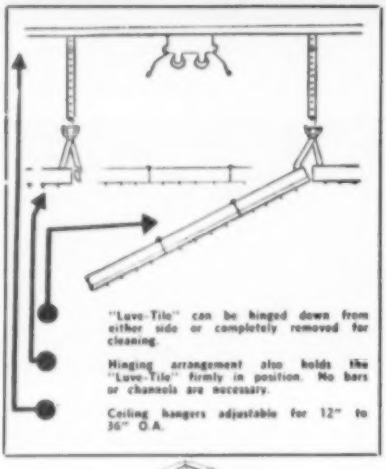
Variable lamp sizes — from 150 to 500 watts — permit day-to-day changes in lighting intensities. Units can also be converted for accent or directional lighting by use of a semi-silvered lamp and accessory.

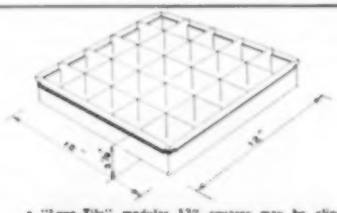
Send for complete SKYLIKE information. A comprehensive booklet describing the SKYLIKE system is yours for the asking. To get your copy, write *Skylike Lighting, Inc., 101 West Main Street, Bound Brook, N. J.*

SKYLIKE LIGHTING, INC. is a Silvray-associated company

Wilson "Luve-Tile"




"Luve-Tile" can be hinged down from either side or completely removed for cleaning.
Hinging arrangement also holds the "Luve-Tile" firmly in position. No bars or channels are necessary.
Ceiling hangers adjustable for 12" to 36" O.A.



• "Luve-Tile" modular 12" squares may be clipped together to form door sections.

THE BEAUTIFUL NEW ILLUMINATED CEILING

• Wilson "Luve-Tile" presents to engineers and design-conscious people the practical tool to ideal lighting. The basic unit consists of a one foot square louvered panel, moulded from Monsanto styrene plastic. Each panel weighs 13 ounces and contains 25 cubes which provide 45° lengthwise and crosswise shielding. Luve-Tile ceilings provide lower ceiling brightness, especially for higher intensities, from 50-foot candles up.

• Luve-Tile is available in white, pastel pink and blue and as such a variety of interesting and practical coloured ceiling patterns are possible. A variation of the pattern effects may be obtained by the use of coloured lights.

• A simple hinging arrangement as illustrated provides easy maintenance. Dirt collection is less rapid or noticeable than with other types of luminous ceilings. Luve-Tile is rigid to handle, light in weight, and simple to remove and wash.

For complete details and prices, write for illustrated catalogue.

J. A. WILSON LIGHTING & DISPLAY INC.

995 MAIN ST. — BUFFALO 3, N. Y. — Phone Grant 2135

In Canada: 280 Lakeshore Road, Toronto 14, Ontario

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(Continued from page 26A)

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Paul H. Lamson

Lithonia Lighting Products Co., Inc.
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Louisiana Power & Light Co.
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Revere Electric Supply Co.
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Arthur Peterson

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Rockland Light & Power Co.
Nyack, N. Y. *D. S. Schaab*

Rohm and Haas Co.
222 W. Washington Sq., Philadelphia 5, Pa.
W. T. Reedy

Ruby Lighting Corp.
1212 S. Olive St., Los Angeles 15, Calif.
Albert Jassim

(Continued on page 42A)

(Continued from page 41A)

Ruby-Philite Corp.
32-02 Queens Blvd., Long Island City 1, N. Y.
Louis Phillips

Rumsey Electric Co.
1007 Arch St., Philadelphia 7, Pa. *T. W. Lauer*

Ryall Electric Supply Co.
1160 Stout, Denver, Colo. *C. O. Ryall*

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Sandel Manufacturing Co.
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Chas. H. Talbot

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J. A. Meacham

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R.K.O. Bldg., Radio City, New York 20, N. Y.
J. M. Gilbert

Smithcraft Lighting Division
A. L. Smith Iron Company
217 Everett Avenue, Chelsea 50, Mass.
Hugh M. Nasor

Smoot-Holman Co.
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L. A. Hobbs

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Southern Canada Power Co., Ltd.
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George R. Atchinson

Southern Colorado Power Co.
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Southern Lighting Mfg. Co.
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Bernard S. Heller

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Thompson Electric Co.
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Triangle Industries
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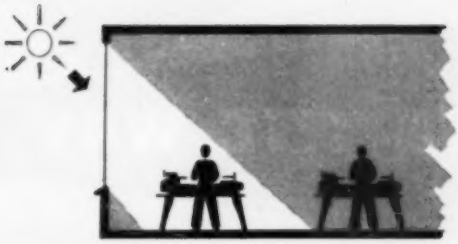
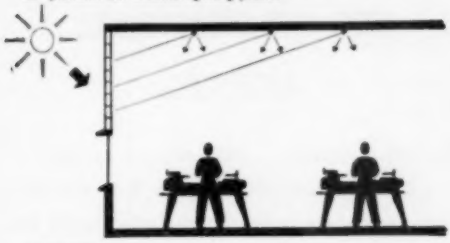
daylighting buildings

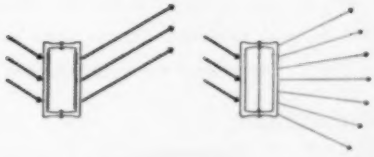
WITH PITTSBURGH CORNING GLASS BLOCKS



QUESTION . . . How can we achieve the control of daylight over wider working areas in offices, schools and shops to complement our electric lighting plans?



ANSWER . . . PC Functional Glass Blocks are especially designed to direct or diffuse natural daylight, so that it may be properly controlled for maximum illumination, with comfort. This diagram shows how a room is "daylighted" with PC Light-Directing Glass Blocks.



TWO TYPES of PC Functional Glass Blocks are available—light-directing and light-diffusing.

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In addition to many purely decorative patterns, PC Glass Blocks are available in *functional* patterns that specifically *direct* or *diffuse* daylight. With PC *Functional* Glass Blocks, the most exacting daylight control and distribution needs can be met without shading. These functional patterns include two principal types. One type controls light by *bending* or *directing* it upward. The other type by *diffusing* it. The light-directing glass blocks, installed above eye level, have internal prisms that project incident daylight above the field of vision and thus distribute illumination with remarkable uniformity throughout the room. The light-diffusing glass blocks break up harsh rays and flood interiors with softly diffused light of high quality.

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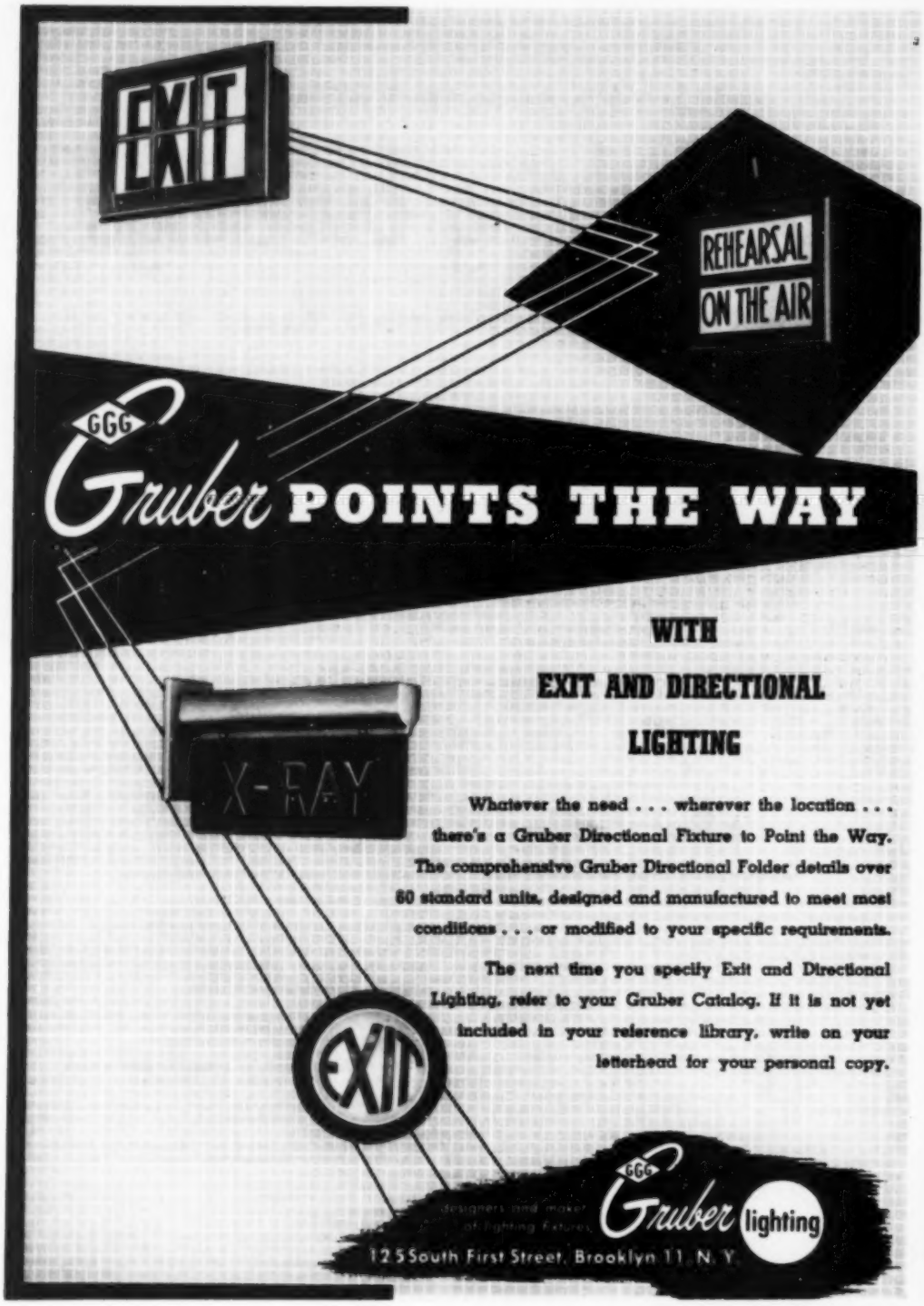
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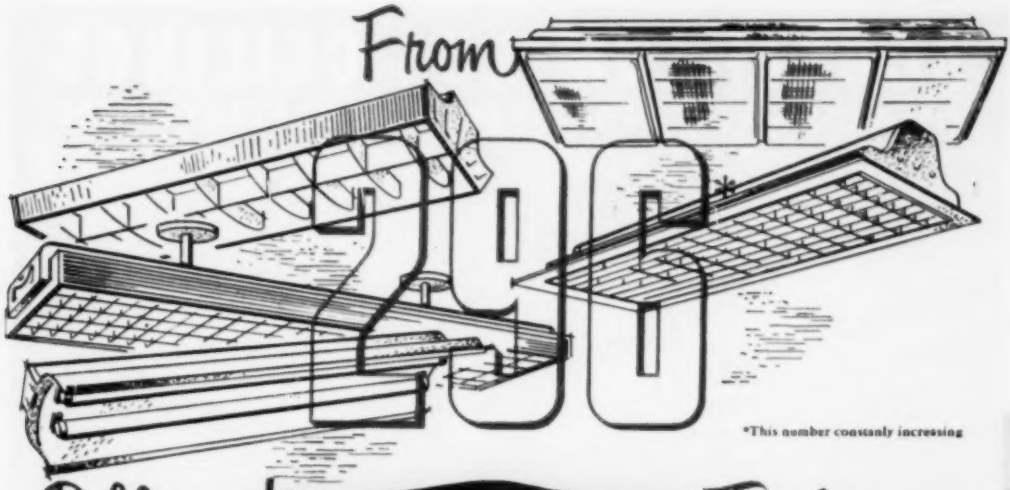

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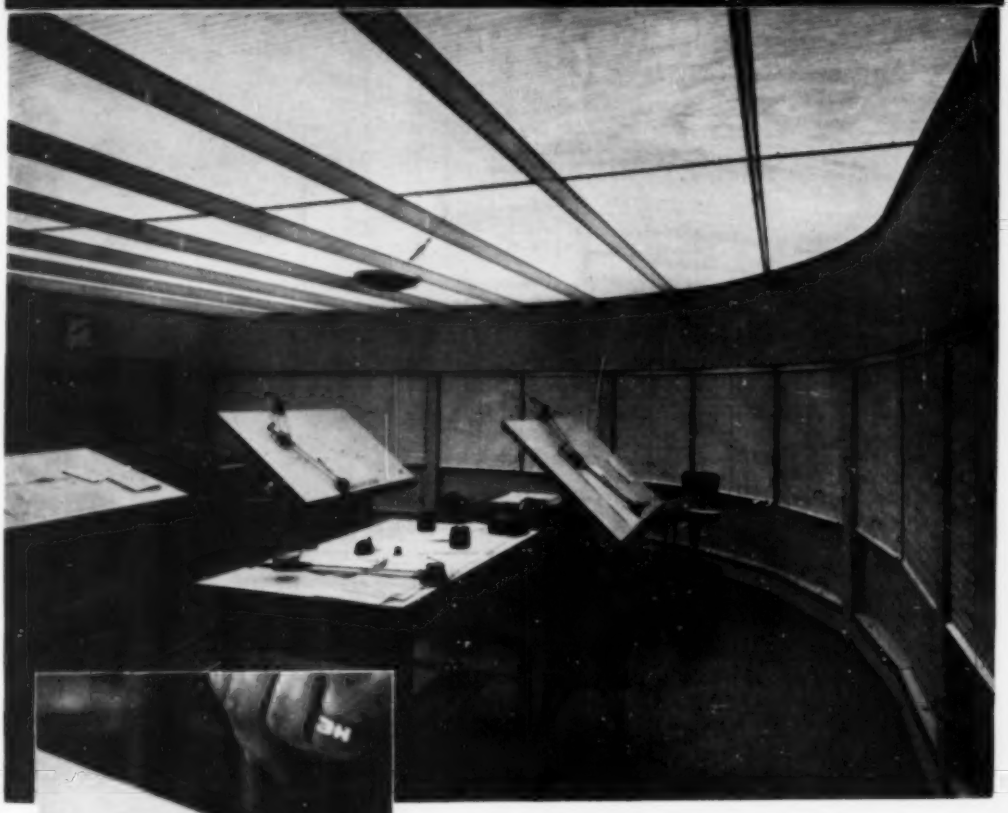

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(Continued from page 22A)

colored pictures, color systems and scales, and color nomenclature used in various technical fields. The last fourth of the volume deals with the physics and psychophysics of colorant layers: gloss, opacity, Kubelka-Munk mathematical analysis of the reflection and transmission of light by a light-scattering layer, identification of colorants, and formulation of colorants.

The author is Chief of the Colorimetry Unit, National Bureau of Standards.

***Modern Lighting Technique** by Harry Hewitt, published by Edward Arnold & Co., London, 1952; available in U. S. from Longmans, Green and Co., Inc., New York City; 223 5¾ x 8½ inch pages, 89 illustrations; $4.00.

The past twelve months have seen the publication of several new lighting texts. This, the third British venture we have reviewed in 1952, is based on the author's lectures on illuminating engineering to students preparing for the London City and Guilds intermediate examination. The text was developed as a practical volume on the scientific aspects of lighting technique and equipment used for general lighting indoors and on roadways. It covers light and vision, light sources (64 pages mostly on theory and operation), light control, and interior and street lighting applications.

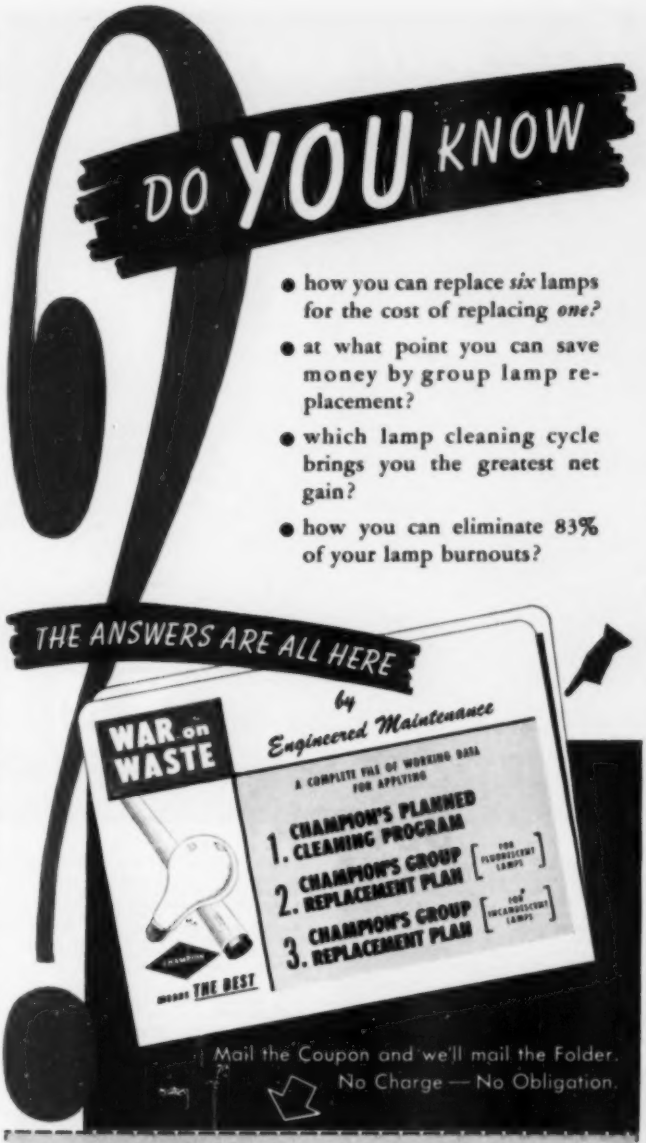
***Planning and Building the Modern Church** by William Ward Watkin, published by F. W. Dodge Corporation, New York, 1951; 172 9 x 12 inch pages, liberally illustrated with photographs and drawings; price $8.50.

This book, another of the *Architectural Record* series, analyzes church building from the preliminary plans to the finished building. The author stresses that the construction of a church or synagogue is a cooperative effort of the clergy, lay church members and architect. The architect must understand the ritual and traditions of the individual church.

Although only about four pages are devoted specifically to lighting, many of the fundamental concepts throughout the book should be very helpful to those planning church lighting installations. Topics treated include a history of the past fifty years of church planning, procedures for the church to follow in setting up a building program, materials, exterior design, interior design (with a special chapter on the chancel, "the heart of the church"), furnishings, the church school, and an 8-page chapter on lighting, heating and air conditioning.

Professor Watkin opens the lighting treatment as follows: "Church lighting

(Continued on page 48A)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Every manufacturer, regardless of the product he makes, knows that in one way or another it is possible for one of his competitors to reduce the quality of the product and sell it at a lower price. This is especially true in the manufacturing of products in which the performance can only be exactly demonstrated with scientific instruments. For example; a fluorescent lamp ballast, alleged by the manufacturer, name plate to be a dual 40 watt design, but which actually delivers 31.1 watts on the leading circuit and 39.4 watts on the lagging circuit and has a power factor of only 85.5% is far below the minimum standards required for proper lamp operation. Ballasts with such sub-standard characteristics should be sold at scrap prices—not at merely a few cents below the price of good ballasts.

We invite manufacturers who want to build quality fixtures to visit our plant and to see for themselves how Acme Electric ballasts are constantly being improved thru research, how they are produced economically by modern manufacturing methods, how each and every ballast is tested, to show you our salvage department, which separates the copper, steel and compound for the scrap market. Sure, we make a few mistakes—but we don't sell them.

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TRANSFORMERS

(Continued from page 47A)

has not kept pace with other elements of modern church building. Advanced modernists still hang rows of glass bowls from the ceiling . . . makeshift planning which is no better than the Victorian dullness of the past." The author advocates dark ceilings, a low level of illumination (6 to 8 footcandles) at pew level from unobtrusive luminaires, with a much higher level at the sanctuary and chancel provided by concealed lighting equipment. He mentions the lack of lighting maintenance in churches as compared with commercial and industrial buildings as one point which should be considered in the design.

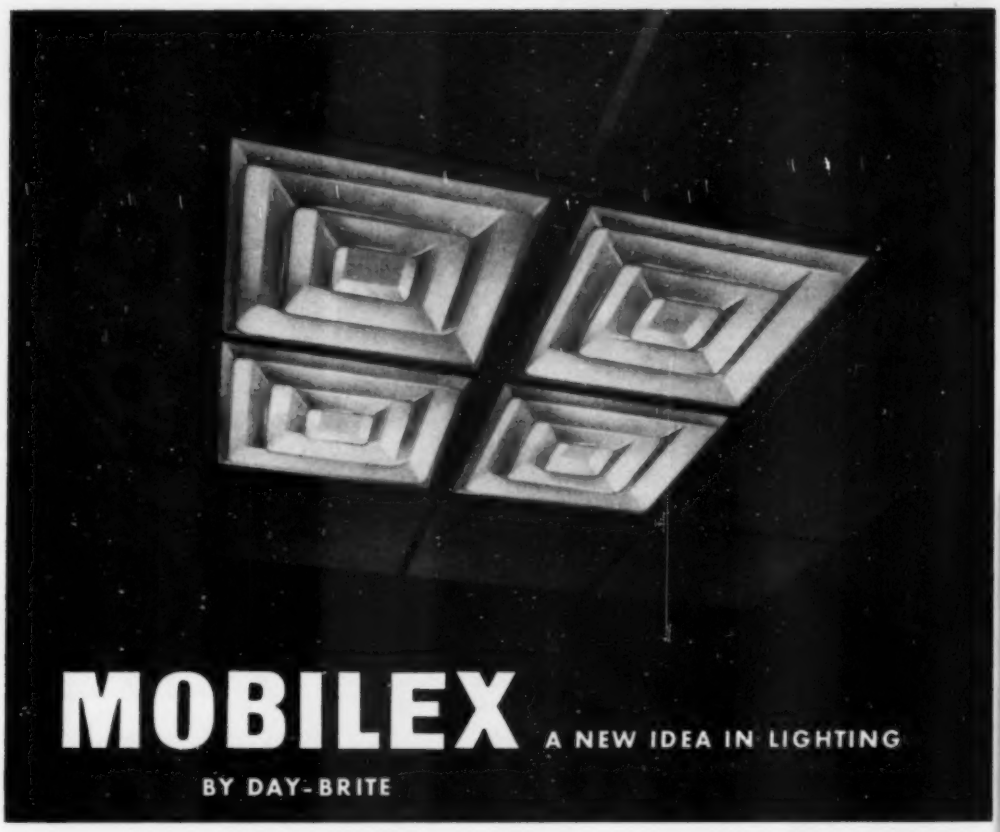
The author is Head of the Department of Architecture at Rice Institute, Houston, Texas.

***Fluorescent Lighting**, edited by C. Zwikker, published 1952 by N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands; available in U. S. from Elsevier Press Co., Inc., 402 Lovett Blvd., Houston, Texas; 262 6 x 9¼ inch pages, 192 illustrations; price $6.25.

This is an excellent addition to the growing Philips' Technical Library series of books relating to illumination. Even though parts of it parallel Amick's *Fluorescent Lighting Manual* another author's approach always brings new ideas and new ways of looking at the same material. In this case it is not just the same material since the Philips' book deals with lamps and lighting on the Continent and in England as well as in the U.S.A. The authors (the volume was written by nine members of the Philips' staff) have made a point throughout to compare American, British and Dutch lamps and application techniques, although, and understandably so, the bulk of data indicate Dutch practice. The authors seem well acquainted with current trends in the American lamp industry.

Topics treated include luminescence, fluorescence and phosphorescence; luminescent substances; color of light emitted by tubular fluorescent lamps; color rendering; gaseous discharges; lamp construction; factors affecting efficiency; lamp types; starters; circuits; ballasts; luminaires for fluorescent lamps; fundamentals of lighting design including brightness relationships and the Weston method; and applications in industry, offices, schools, drafting rooms, stores, sports, restaurants, theaters, museums, residences, vehicles, streets, and agriculture.

The author states that this new English edition contains considerable information on developments since the publication of the original Dutch text in 1950. German and French editions are also available.



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BY DAY-BRITE

MOBILEX introduces a new, flexible recessed lighting system designed for use as an integral part of the newly developed grid-type suspended ceiling which consists of interlocking "tees" supporting Fiberglas* Ceiling Boards.

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MOBILEX is extremely flexible. Units may be used singly, end to end, or side by side . . . and in any combination. A wealth of interesting patterns is possible.

Installation is simple. Compress the sides of the fixture to clear ceiling rails. Insert the fixture into the grid opening and let it rest on the rails. End baffles lock the compression feature in place. Make electrical connections, add hinged shielding frame and installation is complete.

MOBILEX is new, practical and competitively priced. Here's a perfect answer for those tough remodeling jobs and new projects with a limited budget. Get the full MOBILEX story. Write for Bulletin OD-567—today.

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ABOVE: Easy to install. Simply compress the sides of the fixture and insert it into the grid opening.

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● The new Fort Worth National Bank Building, which provides the largest office space of any single building in the city, is lighted *throughout* with Leader's OFFICER fixtures. According to Mr. John Stanley, building manager, the reasons for selecting the OFFICER are that the "fixtures proved to be lower in maintenance—offered a higher light output—and made a more attractive appearance and styling . . ."

Thank you, Mr. Stanley! The ever-growing popularity of the OFFICER in all parts of the country shows that these units meet a widespread need for truly fine fixtures that are outstanding in efficiency, economical operation, and beautiful in appearance.

New Fort Worth National Bank Building. Architect, Preston M. Geren. Electrical contractors, Wills Electric Co. The 2800 Leader OFFICER units used in the building were furnished by General Industrial Supply Corp.

At left: a typical lighting installation in one of the offices.

Leader's OFFICER

The OFFICER is available for 2, 3 or 4 tubes, either regular 40-watt or Slimline in 48", 72" or 96" length. Translucent plastic side panel and injection-moulded one-piece plastic louver* with choice of 45° or 31° angle. Plastic will not warp or discolor. OFFICER units may be used singly or mounted in continuous rows, direct to ceiling or suspended.

*Made under patent No. 2566817

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3 OUT OF 4

CLASS "A" WINNERS OF GOLD SEAL AWARDS USED UNISTRUT®

CHANNEL, HANGERS AND FITTINGS

Entry No. 284

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Over toolmaker's benches continuous rows of louvered, double 40-watt fixtures are supported by UNISTRUT channel at a height of 8'6". Over machines (in other photo) the same type UNISTRUT supported units are installed on 8' centers in rows 7' apart.

Unique metal framing system contributes perfect fixture alignment, added safety and better appearance to winning industrial lighting installations.

In the Merit Award Competition sponsored by the Fourth International Lighting Exposition (Cleveland, May 6-9, 1952), Gold Seal Awards were made for three outstanding industrial lighting jobs* using the UNISTRUT system of fluorescent fixture supports.

The advantages of using the UNISTRUT method as shown in the accompanying photos are obvious. It permits faster, easier, more accurate installation—requires fewer hanger stems and canopies. Cleaning and servicing cannot disturb fixture alignment. Lowers wiring and rewiring costs. UNISTRUT channel is approved as wireway in Chicago and more than 20 other major cities—additional proof of its versatility and usefulness. Try it on your next lighting job!

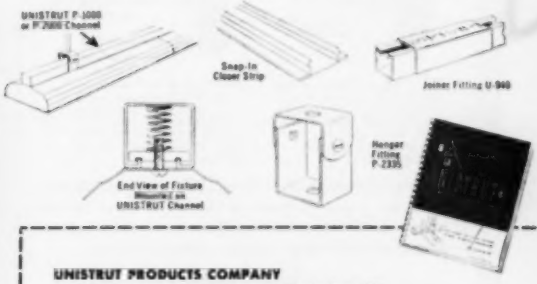
*Planned and executed by G. E. Pieper, Materials Engineer, Spencer Thermostat Division, Metals & Controls Corporation, Attleboro, Mass.

Entry No. 287

In the finished rolling mill of this plant, continuous rows of fixtures are supported by UNISTRUT channel.

Entry No. 290

In this high bay area the lighting units are supported in 3 continuous rows by UNISTRUT channel at a height of 21' to avoid a traveling crane.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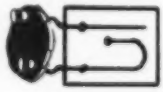
A Life Saver For Fluorescent Lamps

New performance data (taken from tests conducted for us by the Electrical Testing Laboratories, Inc.) prove that fluorescent lamp life can be 100% greater . . . when SENTRY air-thermal type starters are used as opposed to glow switch type starters.

SENTRY air-thermal starters provide one continuous uninterrupted preheating period which light fluorescent lamps with one starting cycle and with but one voltage surge.



Glow switch starters in contrast light fluorescent lamps by providing cumulative preheating, through quick successions of many starting cycles and voltage surges.

The lamp life tests are identical in all respects except for the types of starters used. The data covers all of the conditions and equipment of the tests including the individual ballast characteristics.

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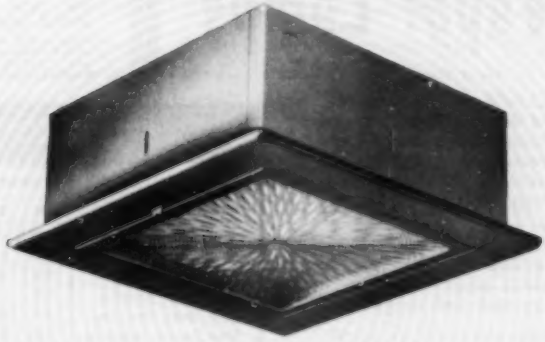
Announcing — Sunbeam's new recessed incandescent line



50100 SERIES

Constantly expanding to provide greater service to lighting, Sunbeam now offers a new line of incandescent fixtures. Various designs and sizes available to fulfill prescribed illumination requirements with added features for installation and maintenance ease. A typical unit is the 50100 series, a shallow recessed box (10⅛" square, 4⅜" deep) having a 8½" Controlens® and polished aluminum reflector. Speedy access to lamp achieved by "finger control" latch and drop-type hinge for bottom panel. Inquire, today, for further info.

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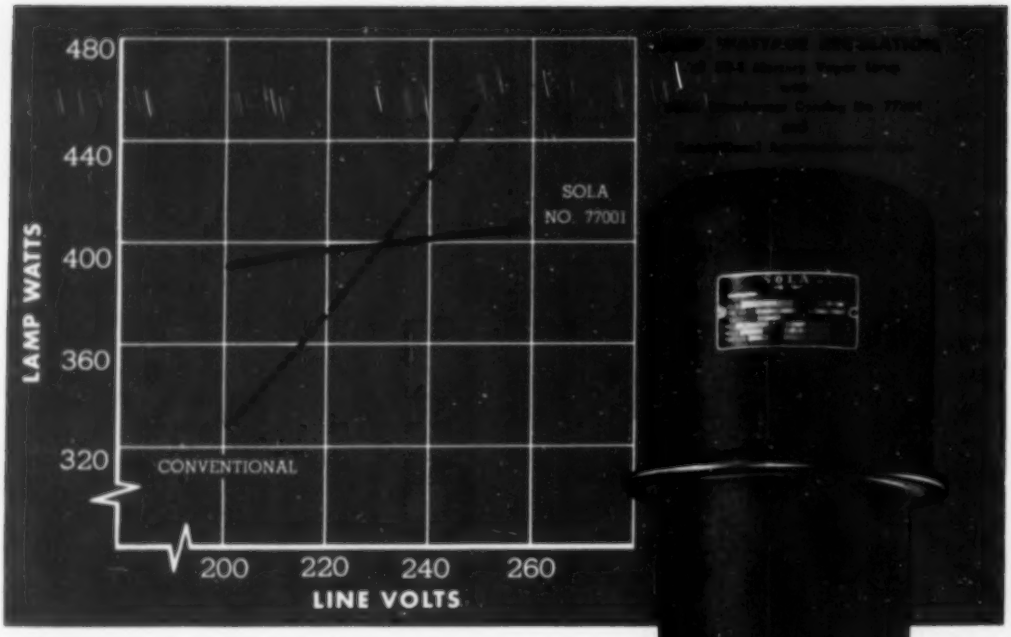

Constant Wattage for Mercury Vapor Lamps

OUTDOOR TYPE CAT. NO. 77001 IS ILLUSTRATED HERE.

Made under one or more of the following U.S. patents: 2,143,745; 2,212,198; 2,346,631; and Pats. Pend.

Now available after three years of actual field use on municipal street lighting networks . . . Sola Constant Wattage Transformers for Mercury Vapor Lamps. Field performance surpassed all expectations. This outstanding Sola development brings efficiency of operation not possible with conventional autotransformer types. Principal advantages of the patented Sola circuit are:

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4. *Elimination of lamp outages due to voltage drops.*
5. *Low heat rise.*
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Three types are available for multiple operation of the EH-1 or JH-1 400 watt lamp at 60 cycles; nominal voltages of 115v, 230v or 460v. Outdoor and indoor units.

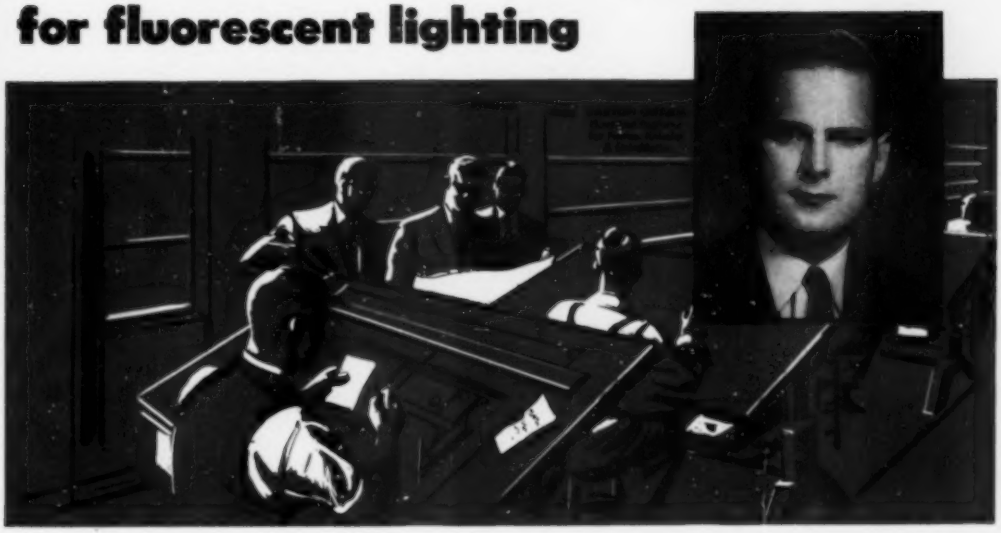
WRITE FOR BULLETIN C-MV-166 WHICH GIVES COMPLETE DATA

Electrical characteristics of a typical unit operating from a nominal line of 230 Volts.

SOLA TRANSFORMER CATALOG NO. 77001	PRIMARY VOLTS		
	200	230	260
Primary Watts	435	443	433
Primary Current	2.18	1.94	1.78
Open Circuit Voltage	330	348	353
Lamp Volts, Operating	133	133	133
Lamp Watts, Operating	392	400	406
Lamp Current, Operating	3.20	3.32	3.42
Watts Loss	43	43	47
Efficiency, Percent	90.	90.	89.
Power Factor, Percent	99.8	99.7	99.8

SOLA *Mercury Vapor Lamp* **TRANSFORMERS**

Architectural firm tells why it always specifies CERTIFIED BALLASTS for fluorescent lighting



Fulton, Krinsky & DelaMotte, prominent Cleveland architectural firm specializing in schools, requests CERTIFIED BALLASTS in *all* fluorescent fixtures they specify.

Mr. Barton Quarm, their electrical engineer, says, "We always specify Certified Ballasts because we want trouble-free installations. Client satisfaction is assured by using Certified Ballasts."

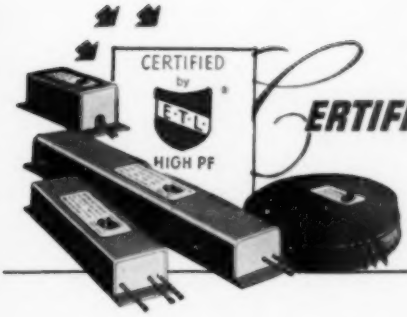
More and more CERTIFIED BALLASTS are being specified and used because CERTIFIED BALLASTS assure—

Full Lamp Life **Rated Light Output** **Maximum Ballast Life**

CERTIFIED BALLASTS are made to precise specifications, then tested by Electrical Testing Laboratories, Inc., which certifies they conform to these high standards.

Write for complete information on the types of CERTIFIED BALLASTS available from each participating manufacturer.

Participation in the CERTIFIED BALLAST program is open to any manufacturer who complies with the requirements of CERTIFIED BALLAST MANUFACTURERS.



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